Paralympic Sport Management System

(PSMS)

By
Chan Foo Keong
(WET 990034)

Under Supervision
Miss Nor Aniza Abdullah
Faculty of Computer Science and Information Technology
University of Malaya

Moderator
Mr. Woo Chaw Seng
Faculty of Computer Science and Information Technology
University of Malaya

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Abstract

Paralympic Sport Management System (PSMS) is a management information system that will manage the Paralympic sport organized by Malaysian Paralympic Council (MPC). PSMS utilize the web-based technologies to perform as an Intranet system and will replace the current manual system in MPC. PSMS will integrate with another two system and the system was named as Paralympic Information and Management System (PIMS). The two systems are: Paralympic One-Stop Center, an Internet system and Paralympic Athletes Management System, an Intranet system.

PSMS has been divided to three section, administrator section, assistant administrator section and user section. The administrator section will allow the administrator to create new database for a new Paralympic sport event. While, the assistant administrator will maintain the volunteers' information, create the committee structure for the sport event, generate the technical competition report, and arrange the schedule and venue for every game type. The technical competition report includes the equipment and result management. Finally, the user section contains only one module, which is the search module to provide a search engine when access to the system.

It is believed that the final product will able to provide a systematic and reliable management information system for MPC.

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Chapter 1: Introduction

1.1 Project Definition

Paralympic Sport Management System (PSMS) is a management information system that helps Malaysian Paralympic Council (MPC) to organize a Paralympic game or Paralympic sport event from the initial until the end of the event via an Intranet system. Paralympic sport is the sport for all disability groups. This system will utilize the web base technologies to provide a systematic and reliable system in Paralympic sport management. It provides some useful modules to handle some of the activities in Paralympic sport management.

When MPC having a Paralympic game, they need to form an organization team or committee structure to handler and monitor all activities in a game. All the sub committees have their own responsibility, e.g. volunteer selection and training, manage the equipments, and arrange the schedule or venue. This system can be used for these sub committees to store and retrieve their members' detail and game information. All data will be stored by the administrator and assistance administrators in the database on the server and available for users reference at any time.

PSMS will be integrated with another two systems to provide a collaborative system named as Paralympic Information and Management System (PIMS). PIMS will automate the current manual system in MPC. The two systems that will be integrated with PSMS are:

- ✓ Paralympic one-stop center (POSC)

  Paralympic one-stop center is a web-based/Internet system that displays all the information about MPC, information in every sport event, and will contains an online registration for volunteer athletes.

- ✓ Paralympic Athletes Management System (PAMS)
  Paralympic Athletes Management System is an Intranet system that will store and retrieve all the athletes' information.

1.2 The Problems and Inconveniences in Current System

PSMS is an alternative for MPC to replace the current system. Currently, MPC is using manual or paper-based system. This method is not effective and causes a lot of problems and inconveniences. The problems are:

- ✓ Not efficient and unreliable in storing large number of data.
- ✓ Data is not arranged properly.
- ✓ Time loss in searching data.
- ✓ Hard to update the data.
- ✓ Wasting money in papers, manpower, places and etc.

1.3 Project Motivation

In MPC, they are using manual system to manage the Paralympic sport system. The system causes problems and inconveniences to the users as mention in earlier part. Therefore, PSMS will be developed to enhance the current system.

In general, PSMS will computerize the current paper-based system for Paralympic games management. With this concept, it helps to reduce the cost, incur time and manpower. In comparison to the current paper-based environment, it is no doubt the PSMS is far more efficient and cost effective.

1.4 Objectives

PSMS is an enhanced system for the current manual system. PSMS will provide an alternative for MPC to improve the way they store their information. The project objectives are set of realistic and measurable goals to be achieved though the implementation of this system. The objectives are:

- ✓ To develop a system that can operate the management of Paralympic games and sport events organized by MPC. This system able to improve the performance in current system and provides an alternative for MPC to replace the current system.
- ✓ Reduce time loss and dissatisfactions occurred in current system.
- ✓ To increase the efficiency of retrieving data and improve the workflow efficiency.
- ✓ Provide a systematic database system to store and retrieve data for every game organized by MPC. With this system, MPC able to maintain the database in every game or sport event.
- ✓ Integrate with another two system (PAMS and POSC) to provide a collaborative system that automated the current manual system.

1.5 Project Scope

The project scope defines the problem areas that the proposed system will attempt to tackle. The scope of PSMS include:

General Section:

- ✓ Security Module

  This module prevents unauthorized administrator and assistant administrator to access the database.

Administration Section:

This section has been divided to two parts, Administrator Section and Assistant Administrator Section.

i) Administrator Section:

- ✓ Sport Event Module

  Create a new database for a new game or sport event.

ii) Assistant Administrator Section:

- ✓ Committee Module

  Organize the committee for a new game.

- ✓ Volunteers Module

  This module contains the volunteers' detail information.

- ✓ Event Schedule Module

  This module includes the timetable and schedule for every game.

- ✓ Event Result Module

  This module manages the result for every game.

- ✓ Equipment and Technician Module

  This module includes the technician and list of equipments.

User Section:

- ✓ Search Module

  Provides search engine for user.

However, this system still has some limitations and constraints. The limitations and constraints are:

- ✓ The process in a real sport event is too complex and contains too much of steps. Thus, some of the modules may not included in the system to handler every complex processes in a sport event.
- ✓ PSMS is an Intranet system. Only the MPC's staff are allow to access to the database.
- ✓ PSMS is a computer system to run a game or competition, which is not a system that can operate for daily use. PSMS will just be used when MPC organize a Paralympic game.

1.6 Expected Outcome

PSMS is a computer information system that provides a better alternative for the current system. This system will show some improvements. The expected outcomes are as below:

- ✓ Provide database computer system in storing information and data.
- ✓ User friendly and easy to use.
- ✓ Using Graphical User Interface (GUI) concept.
- ✓ Easy for enhancement and maintenance.

1.7 Project schedule

System analysis and design involves many different types of activities that together make up a project. A schedule can make sure the tasks are completed in a timely fashion and managed properly. A project is a planned undertaking of scheduled activities and its management to reach a goal. Planning is done to:

- ✓ Define the goals
- ✓ Define and allocate resources
- ✓ Establish time table, schedule work
- ✓ Track and monitoring project
- ✓ Report and document the project

The figure below shows the schedule for PSMS development in order to meet the project milestone:

ID	Activities	Start	End	Duration
1	Semester 1	6/11/2001	10/5/2001	17w
2	Identifying Objective	6/11/2001	6/22/2001	2w
3	Literature Review	6/22/2001	7/26/2001	5w
4	System Analysis	7/20/2001	8/16/2001	4w
5	System Design	8/13/2001	9/7/2001	4w
6	Semester 2	10/19/2001	2/21/2002	18w
7	System Coding	9/3/2001	12/21/2001	16w
8	Sytem testing	11/5/2001	1/4/2002	9w
9	System Implemetation	1/7/2002	1/18/2002	2w
10	System Documentation	6/22/2001	2/21/2002	35w

Figure 1.1: Project Schedule

1.8 Thesis Organization

Chapter 1: Introduction

This chapter gives an overview for the Paralympic Sport Management System (PSMS). It includes the objectives, project scope, project limitations, and project schedule.

Chapter 2: Literature Review

Chapter 2 is a review on literature research. It gives a detail idea about Paralympic sport and PSMS. It also contains the study in existing system and computer technologies that may be used to develop the system.

Chapter 3: Methodology

Chapter 3 introduces the model to develop the system, decision on development tools, client's requirement and run time requirement.

Chapter 4: System Design

This chapter shows the system design, which includes the system module structure and how the system works.

Chapter 5: System Implementation

Chapter 5 discusses the development environment, steps in project development and coding stages. Some coding examples also included in this chapter.

Chapter 6: System Testing

Chapter 6 discusses the technique in system testing and also contains a test case report.

Chapter 7: System Evaluation

Chapter 7 discusses the system limitation, problems encountered, system strengths, and future enhancements.

Chapter 8: Conclusion

This chapter includes the conclusion of PSMS report.

Chapter 2: Literature Review

~Approach to Literature Review
~Findings
~Study in Existing System
~Analysis and Synthesis
~Computer Technology
~Chapter Summary

Chapter 2: Literature Review

A literature review is a research on a topic or find out the related issues regarding the topic. It will findings on previous studies and others implication or statistics on the current system.

2.1 Approach to Literature Review

Literature or research is the first process in developing a computer system. The literature review make up of the following steps.

2.1.1 Interview in Sport Science Center, University of Malaya

The first interview was conducted in Sport Science Center, University of Malaya with Mr. Afizal Abu Othman, one of the officers in Sport Science Center. The purposes of this interview are to get a detail idea in sport management and study the current system in Sport Science Center.

2.1.2 Interview in Malaysian Paralympic Council (MPC)

Another interview section has been conducted with Mr. Kamaruzaman Kadir, manager in sport management in MPC. The information that have been collected from this interview were:

- ✓ Information about MPC
- ✓ Information in Paralympic sports and Paralympic sport management
- ✓ How the current system works
- ✓ What are the weaknesses in current system
- ✓ Client's requirements

2.1.3 Reading

Information was also gathered through reading articles from Internet, books, and seniors' thesis, journals and references material from library. The information that have been gathered were:

- ✓ Issue related to sport
- ✓ Information in sport management and Paralympic sport
- ✓ Computer technologies to develop PSMS
- ✓ Techniques in computer application development

2.2 Findings

After gathered all the information related to the issue from methods listed as above, this information has been analyzed and the result has been divided into the following parts:

2.2.1 Malaysian Paralympic Council (MPC)

As mention earlier, PSMS will be used by MPC's staff to replace the current system. Thus, MPC is the client for this system. With the government's help and encouragement the Malaysian Sport Council for the Disabled was formed in May 1989 as a non-government organization or NGO. It heralded the dawning of a new era for the disable, promising swift ramifications in public consciousness.

Renamed as Malaysian Paralympic Council in 1996, MPC remained a non-profile organization recognized and supported by the Ministry of Youth and Sports and the Ministry of National unity and Social Development. Today, it reins as the country's national governing body for the disabled, promoting the concept of "Sports for all". MPC is member of the International Paralympic Committee (IPC) and is affiliated to the Far East and South Pacific Federation (FESPIC). The FESPIC Federation Games are held

once in every four years. Malaysia has been honored to host these games in 2006 in Kuala Lumpur.

As a national organization, MPC is entrusted with the management of several competitions, which include the Malaysian Paralimpiad and ASEAN invitation every two years. The key consideration is for MPC to provide rehabilitation, better health and active recreation for the disabled. The emphasis is on full participation and equal opportunities.

MPC's remarkable growth and progress have been largely due to the Malaysian government's solid backing. The organization's objectives and mission are strongly promoted by the Ministry of National Unity & Community &Development & the Ministry of Youth & Sports. In line with MPC's philosophy, disable athletes are encouraged to strengthen and reinforce their mind, body and spirit.

MPC Vision:

"*The existence of a Disabled community that is progressive, productive, confident, competitive, relevant and integrated with the society through the Paralympic Games Movement.*"

MPC Mission:

"*Dedicated towards the excellent achievement in the implementation and services plan of the 'Sports For All and "High Performance Sports' for the benefit of a quality life for the Disabled.*"

2.2.2 Paralympic Sport

Paralympic sport is a sport or game event for disability groups. Paralympic sport will help the disables to be more progressive, productive, relevant and integrated with the society. In Malaysia, all the disables can enter over 20 types of game that organized by MPC through a sport event called Paralimpiad every two years. The games are:

✓ Power lifting	✓Badminton	✓ Volleyball (sitting& standing)
✓ Judo	✓Boccia	
✓ Ping pong	✓Wheelchair Basketball	✓ Archery
✓ Fencing	✓Football	✓ Athletics
✓ Shooting	✓Goal ball	✓ Swimming
✓ Lawn Bowl	✓Equestrian	✓ Wheelchair Tennis

In line with MPC's philosophy, disabled athletes are encouraged to strengthen and reinforce their mind, body and spirit through the Paralympic sport. The objectives and goals for Paralympic sport are:

- ✓ To give a wider participation opportunity to the disabled athletes at the state level across the country.
- ✓ In line with the "Sports For All" concept for participation, health, friendship and fun purposes. It is also in line with the "Sports Excellence" concept, which aims to portray the talent, skill and ability of the disabled athletes.
- ✓ To evaluate and recognize the talent and performance of the athletes in order to choose them to fill in the back-up squad, teen squad and national squad.
- ✓ To be physically and mentally prepared in all aspects of skill and experience.

2.2.3 Definition of Sports Management

The term management may use interchangeably with administration. Management frequently relates more to the technical functions of administration. [1] It includes the administration, coordination, and evaluation of any type of event related to sport.

Successful sport management define as being the process of striving toward clearly established objective and goals as a result of working with others and exercising prudent and judicious use of resources and assets – all within the context of a sport-related organization. Sports management is currently used as an umbrella phrase or term encompassing a large number and variety of sport, fitness/wellness, and leisure/recreation programs and activities. [2]

2.2.4 Definition Management System

A system is a collection of objects and activities, plus a description of the relationships that tie the objects and activities together. A computer system consists of hardware components that have been carefully chosen so that they work well together and software components or programs that run in the computer. A filing system is a group of files organized with a plan (for example, alphabetical by customer). [3]

PSMS is a management system and is also a database management system. The management system is the organization structure used by the users to get things done. The management system includes the information system to provide project team members with necessary information, because coordination between groups is critical to integrate activities. Organizational structure involves procedures to ensure accurate communication and completeness of activities. [4] A management system contains an administration tool that can cope the information and data. It contains a program that can control and retrieve data.

A database management system (DBMS) is a program that lets one or more computer users create and access data in a database system. The DBMS manages user requests (and requests from other programs) so that users and other programs are free from having to understand where the data is physically located on storage media and, in a multi-user system, who else may also be accessing the data. In handling user requests, the DBMS ensures the integrity of the data (that is, making sure it continues to be accessible and is consistently organized as intended) and security (making sure only those with access privileges can access the data). The most typical DBMS is a relational database management system (RDBMS). A standard user and program interface is the Structured Query Language (SQL).

A DBMS can be thought of as a file manager that manages data in databases rather than files in file systems. In IBM's mainframe operating systems, the nonrelational data managers were (and are, because these legacy application systems are still used) known as access methods. [3]

2.2.5 Paralympic Sport Management System (PSMS)

The Paralympic Sport Management System is a management information system that can maintain the database and information for every game organized by MPC. This system supposes to maintain all the processes in a game or a competition from the initial process until the end of the game. The system will be used by MPC as an alternative for the current paper-based system via an Intranet system. It means the system can be used by a group of users through a private network. PSMS provides some useful modules to handle a game, this modules include:

- ✓ Volunteers management
- ✓ Result management
- ✓ Equipment management
- ✓ Committee Structure management
- ✓ Schedule and venue arrangement

2.2.6 How MPC Organizes a Game?

When MPC held a Paralympic game, the first step is planning. Planning can be defined as a management function, which establishes goals and objectives and the means by which they can be achieved. Planning prepares the organization for change and reduces the organizational conflict. The questions below show the checklist of some of the conditions that must be determined during planning process: [5]

- ✓ What is the purpose of the event?
- ✓ How large is the event – number of participants?
- ✓ How many venues will be used and how far apart are they?
- ✓ What type of food is appropriate to serve?
- ✓ What housing requirements are needed for athletes, media and spectators?
- ✓ How many staff and /or volunteers does the event require? What additional training will be required for staff and volunteers?
- ✓ What equipments are needed for every event?
- ✓ Is increased security needed?

- ✓ How much storage area is required (equipment, merchandise, ect.)?
- ✓ What is the appropriate entrance fee? And how will tickets be sold and distributed?

After the planning, MPC will form an organization team or committee. The committee structure was shown as figure below.

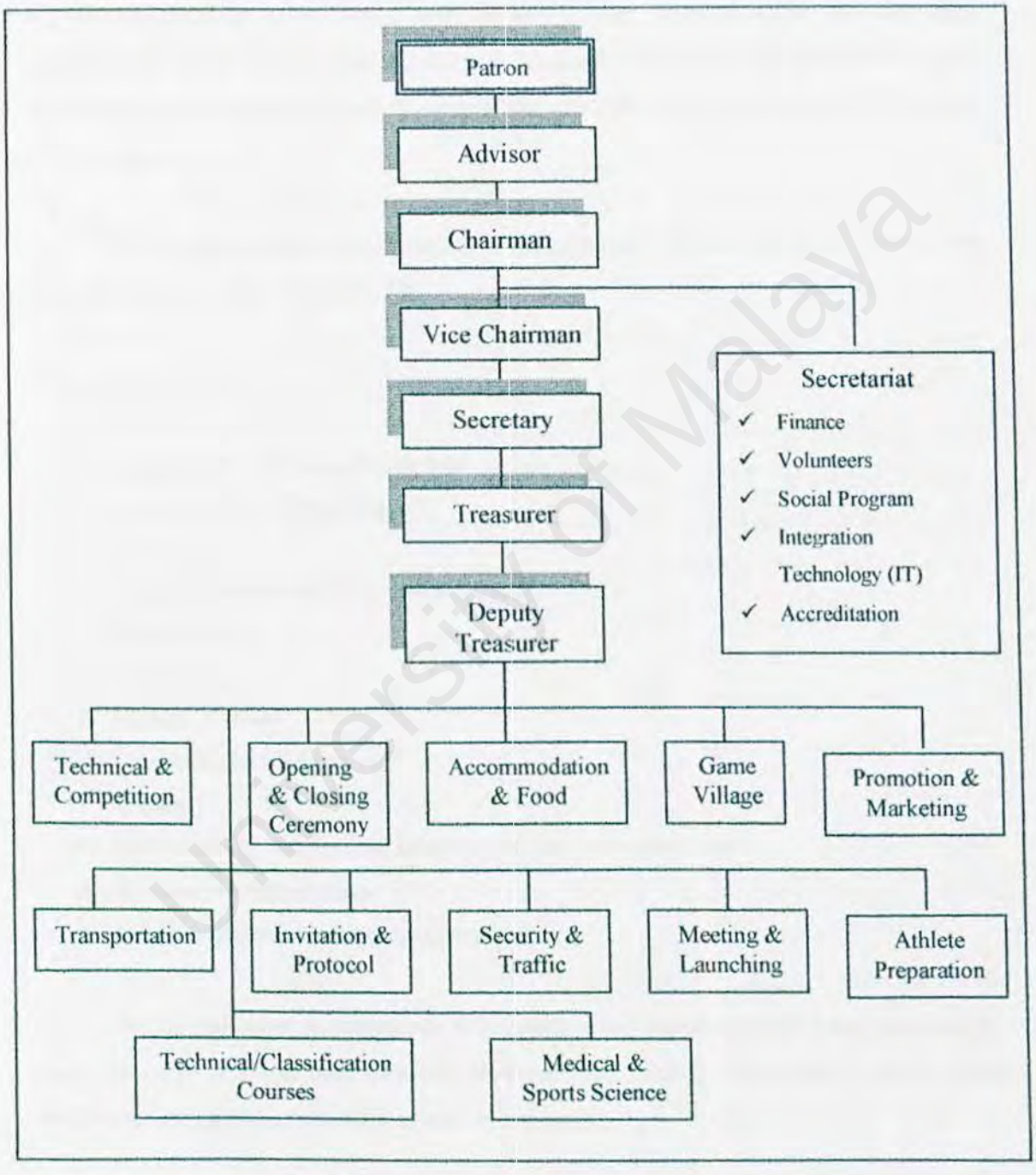

Figure 2.1: Organizing Committee for Paralympic Game

The term committee means organizing maximizes performance levels of the employees or members by defining their functional jobs or tasks, allocating these jobs to appropriately sized department units, and defining the authority function helps to assure clear-cut lines of responsibility and provides smooth and uninterrupted communication flow. [Sport Management Successful Private Sector Business Strategies] This committee will be organized for every game held by MPC. Every sub-committee has their own responsibility and monitors all activities in a game. Although the team members in committee won't be the same but the committee structure will be almost similar for every different game.

The list below shows the checklist of things to do in producing a sport event after organize the committee structure: [5]

- ✓ Site selection
- ✓ Permits
- ✓ Advertise through leagues in the area
- ✓ Registration for athletes or teams
- ✓ Sponsors
- ✓ Volunteers, training for volunteers and staffs
- ✓ Games officials
- ✓ Insurance
- ✓ Medical, first aid
- ✓ Equipments or facilities
- ✓ Awards
- ✓ Food, beverage concessions, transportation and accommodation
- ✓ Sound equipment, staging
- ✓ Schedule or timetable for every tournament

In the real sport management, it contains more complex process and may not be same for every different kind of event. However, the checklist above shows some of the important processes that need for almost every event.

2.2.7 Planning for the Disable

As a producer of a Paralympic sport management, MPC need to identify all venue limitations and remove barriers for the visually, auditorially, and physically impaired. It is the law to have public facilities for sport events architecturally accessible. In private or public venue, the producer needs to build temporary ramps with plywood or remove stall doors. Changing rooms with seats should also be available for athletes who need to remove artificial limbs prior to competition.

The disabled parking plan is also critical for temporary venues. Frequently, sport events held in temporary locations do not always plan adequately to assign parking for disabled spectators. Make certain that determine how many spaces are required by local ordinance and assign them in the correct location with appropriate signage. There are other aspects that also have to consider in planning of a sport event with disabled athletes. For example, a certain number of volunteers should be assigned as facilitators to help the blind adjust to unfamiliar territory, aid wheelchair athletes up steep grades not built to code, or help in the transfer from the wheelchair into sport equipment or into the pool. This last responsibility requires the volunteer to have some knowledge on appropriate and safe transfer procedures.

Another unique logistical consideration in regard to producing sport events for the disabled are the various categories that must be included, such as wheelchair, stand up, and blind so that the athletes compete on an equal playing field. In addition, there are three levels of visual impairment. If a wheelchair category is included in a regular run, special consideration of the terrain should be made. Avoid steep and windy hills and try to select hard concrete surfaces over gravel surface. [6]

2.3 Study in Existing System

2.3.1 Current System in Sport Science Center, University of Malaya

The purposes of this interview section are to gather information about sport management and study in the existing system in Sport Science Center. Unfortunately, they are using manual system.

When they want to run a competition, the officer will design a form and then print it out. If some one wants to join the competition, he or she needs to fill in the form and pass it back to the officer. After that, the officer will key in their information and store in computer. All the other information will also be listed down in paper and then stored in computer. The current system can just be used in small competition and it is not systematic and unreliable. It is not efficient for bigger event.

2.3.2 Current System in Malaysian Paralympic Council

The PSMS will be used by MPC. Therefore, an interview with MPC has been planned to gather information in Paralympic sport management and understand the system requirements.

Currently, MPC is using manual paper-based system to manage their data. The current system causes a lot of problems in storing a large number of data. In current system, they use two ways to store their information. Firstly, write down in papers. Secondly, key in the information to the computer using Microsoft Excel. When they need the data, they have to find out the files or access to Microsoft Excel to search for it. However, these information are not store in a database system, it stores in different personal computers by different staffs from MPC. It may cause many problems in updating and searching data.

When MPC having a competition, they will send the form to the athletes. After the athletes send back the form, MPC will key in all the information to the computer. For those who want to be a volunteer, they have to get the form from MPC and send it back. The MPC staff then will key in the volunteers' information after the selection have been make. This method also applied to other Paralympic sport information. However, they found many difficulties in this system:

- ✓ Not systematic and reliable
- ✓ Not efficient in searching data
- ✓ Hard to update the existing data
- ✓ Wasting time and manpower

2.3.3 System Done by FSKTM Diploma Student

This existing system was developed by diploma student from University of Malaya, Zurita Binti Basir. This is the first Paralympic Sport Management System developed for MPC. The system will be combined with another two system (done by other diploma students): One-Stop center, which is a web-based system and Paralympic Athlete Management System, which is a stand-alone application.

This system is a stand-alone system and not a web-based application. The system was developed using Visual Basic and using Microsoft Access 97 as system's database. The system was using graphical user interface (GUI) concept and provides a user-friendly interface for user to maintain the database. The system provides some features or modules to manage a Paralympic game. Each of the modules will include add, delete and search functions. The modules are:

- ✓ Games/competition module
- ✓ Volunteer management module
- ✓ Athletes/staffs management module

The game/competition module will show the games or competitions have been joined or will be joined by MPC. While the volunteer management module contains the detail information about volunteers. There are two sub modules in athletes/staffs management module:

- ✓ Accommodation module
- ✓ Competition Report module

The accommodation module includes the accommodation management for athletes and staffs. While the competition report module will calculate the number of athletes and staffs for each game.

The advantages of the system are:

- ✓ Using GUI concept
- ✓ Easy to use, user friendly and contains consistent outlook
- ✓ Provide a database for storing information
- ✓ Contains a summary report to calculate the total number of athletes and staffs
- ✓ User able to add, delete and search information from database
- ✓ Includes a search engine for every module

However the system still has some weaknesses that need to be improved:

- ✓ This system is a stand-alone application that will be run under one personal computer and it was not designed for an Intranet system.
- ✓ Limited functionality of the system. The system has limited modules and functions that make the system become a simple information system. It doesn't provide other module, like: game types module, facilities module and game results module.
- ✓ The system doesn't provide security module to prevent unauthorized users to access to the database.
- ✓ The system is not well organized in running a sport event due to the weaknesses listed above.

2.4 Analysis and Synthesis

After process collecting related information, the information needs to be analyzed to make sure the data are useful. The analysis process will decide which of the information should pay attention to and which information should ignore.

2.4.1 Summary From Interview

Two interviews have been conducted for literature research and requirements specification together with another two group members. First, was in Sport Science Center, University of Malaya and secondly, in MPC.

We take a more deductive approach by using the funnel structure to organize the interview questions, which begin with generalized, open-ended questions and then narrowing the possible responses by using closed questions.

The rationale of this approach is to provide an easy, non-threatening way to begin the interview. A funnel-shaped question sequence is vital when the interviewee needs freedom to express their input. In addition, we would want the interview to elicit more detailed information but still maintain its relevancy. Hence, the frequency of probing questions is reduced.

According to Mr. Afizal Abu Othman and Mr. Kamaruzaman Kadir, Sport management is a large issue that contains many steps and processes. Sport management may contains volunteers or staff management, financial control, communications and marketing, result management, equipment management, game village management, security and traffic arrangement, schedule and venue arrangement and so on. Every sport event may have different management team and processes. But the common processes in organizing a Paralympic sport were shown in chapter 2.2 Findings. When answering the question about the existing system, they haven't automated the current manual system and the current paper-based cause many problems in storing large number of data (refer to

chapter 2.3.1 and chapter 2.3.2). From the interview, client's requirements have been specified and the detail result will be shown in chapter 3.2.

2.4.2 PSMS vs. Existing System

Currently, MPC and Sport Science Center University of Malaya are using manual system that causes many inconveniences. To reduce the problems in current system, PSMS will automate the manual system and provide a systematic way in storing, updating and retrieving data. All data will be store in database and available for users reference at any time. Compare to manual system, PSMS will provides the advantages as following:

- ✓ Systematic in storing and searching large number of data.
- ✓ Easier to update and retrieve data from a database system.
- ✓ Available for users reference at any time through an Intranet system. The data can be shared and displayed by all users include the volunteers, management team and staff in MPC through an Intranet system. The management team also able to check the progress of a game.
- ✓ It is more secure because the entire data can only changed by administrator and assistant administrator.
- ✓ Improve the workflow efficiency and more cost effective due to saving money in papers and manpower.

Compare to system done by FSKTM diploma student, PSMS will provide more functions that operate the Paralympic sport management. The system done by diploma student contains accommodation management, volunteer management, and athletes and staff management. This system is an application that can be accessed by one computer. It able to store the staff and volunteers' information, list of the athletes for every game type, accommodation information, and games that have been participated by MPC. While, PSMS won't contains the accommodation management and list of the athletes for every game type due to this module will be handled by another team members in his system,

Paralympic Athletes Management System (PAMS). PSMS will enhance the system done by diploma student in following parts:

- ✓ PSMS is an Intranet system, which can be accessed by more than one personal computer with an Intranet connection.
- ✓ PSMS is more secure due to password protection. Only administrator and assistant administrator are allow to access and change data in database.
- ✓ PSMS will also use the GUI concept and contains more graphical interface when running in browser.
- ✓ PSMS will also provide a search module. It will help users while searching data in database.
- ✓ PSMS contains some of the modules in system done by diploma student, e.g. staff and volunteer management, games management. Besides, PSMS will also provide some others functions, e.g. equipment management, result management (This two module contain in technical competition module), schedule and venue arrangement, and designing committee structure. Clearly, PSMS is more consistence and useful compare to system done by diploma student in running a big sport event or competition.

2.5 Computer Technology

2.5.1 Intranet

An intranet is nothing more than a private Internet. In other words, it is a private network, usually a LAN or WAN, that enables the use of Internet-based applications in a secure and private environment. As on the public Internet, intranets can host Web servers, FTP servers, and any other IP-based services.

Companies have been using private networks for years to share information. Traditionally, office networks have not been information friendly. Old private networks did not have consistent interfaces, standard ways to publish information, or client applications that were capable of accessing diverse data stores. The popularity in the

public Internet has spawned a whole new generation of inexpensive and easy-to-use client applications are now making their way back into the private networks. The reason intranets are now gathering so much attention is that they are a new solution to an old problem.

The two things that distinguish intranet from the Internet is who can access them and from where they can be accessed. If an application can be used over the public Internet, it will work on private intranets too. [3]

2.5.2 Web clients and server

Client/server describes the relationship between two computer programs in which one program, the client, makes a service request from another program, the server, which fulfills the request. [3]

When user connected to the Internet, user's computer becomes a web client in a worldwide client/server network. User's web browser software-Internet Explorer or Netscape Navigator, for example-is the software that makes user's computer works as a web client. Client/server architecture may be used on LANs, WANs, and on the web. The main characteristic that these three somewhat diverse uses share is a division of the workload between the server and the client. In each case, the client computers typically request service, including printing, information retrieval, and database access. The partner in these activities is the server, which is responsible for processing the client's request.

The division of labor between web clients and web servers is quite distinct. The web client, computer at the office or at home, request information from a particular web server on a distant computer. Using the Internet as transportation medium, the request is formulated into HTTP request and sends to the target computer, the server. A moment later, when the target server receives the request, it retrieves the page or other information that the server requested, formulates it as an HTML formatted page, and sends it back to the requester client via the Internet. When the requested information, an HTML page in this instance, arrives at the client computer, the web browser software determines that the

information is an HTML page. It displays the page on the client machine according to the direction laid out in the page's HTML code. [7]

2.5.2.1 Two-tier Client/Server

A Two-tier Client/Server model involves only a client and server. All communication takes place between the client on the Internet and the target server at the other end. Of course, other computers are involved in the process of transporting packets of information across the Internet. Those details are part of the transportation facility that is handled by TCP/IP. The conversation that occurs between a web browser and a web server is similar to any conversation between client and server generally. [7]

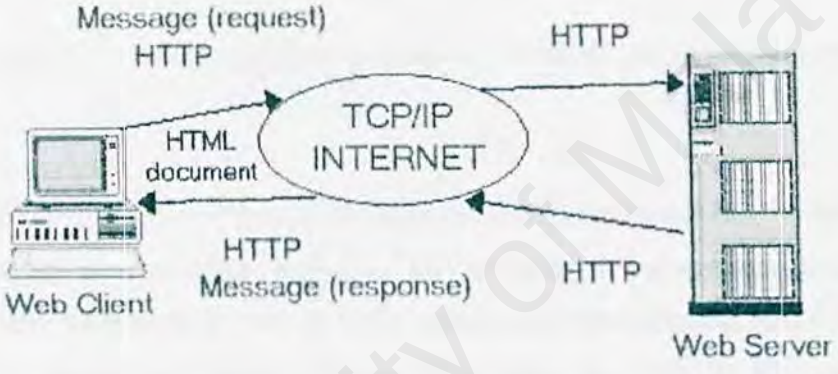

Figure 2.2: Message Flow between a Web client and server in two-tier client/server architecture.

2.5.2.1 Three-tier Client/Server

A Three-tier Client/Server architecture builds on the traditional two-tier approach. The first tier is the client, the second tier is the web server, and the third tier consists of applications and their associated databases that supply non-HTML information to the web server on request. From a software perspective, the three tiers are client processes (tier 1), web services (tier 2), and data services (tier 3). Interaction between client and server operate the same way as they do in a two-tier architecture. The third tier provides comprehensive data services, including database operations supported by database

software, enterprise resource planning software services, and the other services need to support a robust electronic commerce server. [7]

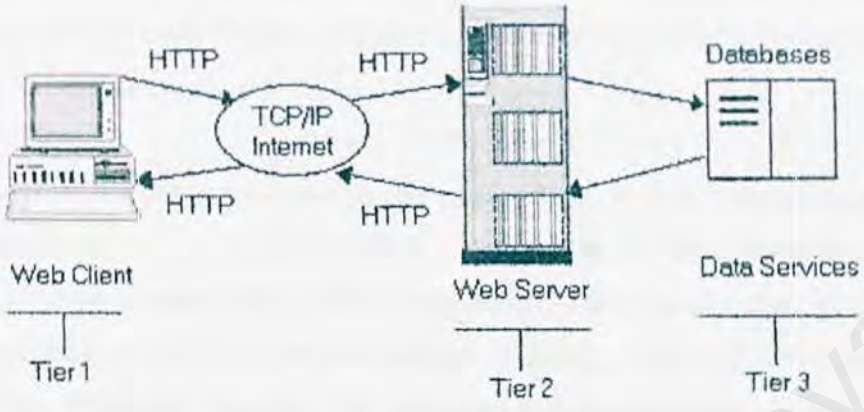

Figure 2.3: Message Flow in a three-tier client/server architecture.

2.5.3 Web server

In general, a server is a computer program that provides services to other computer programs in the same or other computers. The computer that a server program runs in is also frequently referred to as a server In the client/server programming model, a server is a program that awaits and fulfills requests from client programs in the same or other computers. A given application in a computer may function as a client with requests for services from other programs and also as a server of requests from other programs.

Specific to the Web, a Web server is the computer program (housed in a computer) that serves requested HTML pages or files. A Web client is the requesting program associated with the user. The Web browser in user's computer is a client that requests HTML files from Web servers. [3]

2.5.3.1 IIS

Internet Information Server (IIS) is a group of Internet servers (including a Web or Hypertext Transfer Protocol server and a File Transfer Protocol server) with additional capabilities for Microsoft's Windows NT and Windows 2000 Server operating systems.

IIS is Microsoft's entry to compete in the Internet server market that is also addressed by Apache, Sun Microsystems, O'Reilly, and others. With IIS, Microsoft includes a set of programs for building and administering Web sites, a search engine, and support for writing Web-based applications that access databases. Microsoft points out that IIS is tightly integrated with the Windows NT and 2000 Servers in a number of ways, resulting in faster Web page serving.

A typical company that buys IIS can create pages for Web sites using Microsoft's Front Page product (with its WYSIWYG user interface). Web developers can use Microsoft's Active Server Page (ASP) technology, which means that applications - including ActiveX controls - can be imbedded in Web pages that modify the content sent back to users. Developers can also write programs that filter requests and get the correct Web pages for different users by using Microsoft's Internet Server Application Program Interface (ISAPI) interface. ASPs and ISAPI programs run more efficiently than common gateway interface (CGI) and server-side include (SSI) programs, two current technologies (However, there are comparable interfaces on other platforms).

Microsoft includes special capabilities for server administrators designed to appeal to Internet service providers (ISPs). It includes a single window (or "console") from which all services and users can be administered. It's designed to be easy to add components as snap-ins that users didn't initially install.

IIS includes security features and promises that it is easy to install. It works closely with the Microsoft Transaction Server to access databases and provide control at the transaction level. It also works with Microsoft's Netshow in the delivery of streaming audio and video, delayed or live. [3]

2.5.3.2 Apache

Apache is a freely available Web server that is distributed under an "open source" license. Version 2.0 runs on most UNIX-based operating systems (such as Linux, Solaris, Digital UNIX, and AIX), on other UNIX/POSIX-derived systems (such as Rhapsody, BeOS, and BS2000/OSD), on AmigaOS, and on Windows 2000. According to the

Netcraft (www.netcraft.com) Web server survey in February 2001, 60% of all Web sites on the Internet are using Apache (62% including Apache derivatives), making Apache more widely used than all other Web server.

Apache complies with the newest level of the Hypertext Transport Protocol, HTTP 1.1. Free support is provided through a bug reporting system and several Usenet newsgroups. Several companies offer priced support. [8]

2.5.3.3 Netscape Enterprise Server

The Netscape enterprise server (NES) software runs on a representative collection of operating systems: AIX, Digital UNIX, HP_UX, Irix, Solaris, and Windows NT. It provides a powerful development environment that support development of web-based applications that can be run on the Internet, an intranet, or an extranet. NES's content management allows users to create their own Netshares, personal home directories, using and interesting method that provides services including link management, web publishing, agent services, and access and version control. [3]

Like most other server programs, NES supports dynamic application development, including CGI and Netscape's own version of application program interface: Netscape Server API (NSAPI). NES supports the Java Servlet API for server-side applications. A Netscape product called liveware runtime environment is included in NES and allow user to write server-side scripts that, among other things, provide connectivity to a rich of databases, including oracle, Sybase, and Informix. Its ODBC conformance means that NES provides connectivity to other database sources as well. [7]

2.5.3.4 O'Reilly's WebSite Professional

WebSite Professional published by O'Reilly and Associates, supports Windows 95/98 and Windows NT/2000. WebSite Professional has a loyal following of users, a number of add-on tools, flexible scripting, easy installation, and good documentation. It bundles WebView software to manage the site, WebIndex to index documents stored locally, WebFind to search the site, the HomeSite HTML editor, and image map editor. As an added bonus, WebSite Professional includes its own electronic commerce server

program, iHTML Merchant, which allow users to create an online store for electronic commerce.

WebSite Professional's dynamic page generation includes support for Microsoft Active Server Pages. In addition, it supports Java servlets, WebSite Professional servlet, and APIs for both WebSite Professional (WASAPI) and Microsoft's Inetmet Server Application Programming Interface (ISAPI). [7]

2.5.4 Programming Languages

2.5.4.1 Hypertext Markup Language (HTML)

Hypertext Markup Language or also known as HTML is a markup language used to format text and information, i.e. to identify elements of a web page so that a web browser can render the page on a computer screen.

A HTML file can be created using simple text editor such as Notepad. A HTML file will end with either .htm or .html extension. Nowadays, there are many software and editor to create HTML web pages with graphical user interface, such as Microsoft FrontPage, Microsoft FrontPage Express and other software packages.

HTML is the basic language in web programming. However HTML cannot read and write to a file. HTML can just display the information without database. Therefore, they come out with more web programming languages, which are advance version of HTML.

2.5.4.2 Scripting Languages

Scripting is a technique of writing embedded codes, or script, that resembles programming language in a HTML document. The purpose of scripting a HTML document is to enhance the page functionality by allowing a Web page developer to manipulate elements of a Web page dynamically as the client browses that page. A script interpreter executes a script as a web page is being loaded.

i) JavaScript / JScript

JavaScript is a scripting language that allows the scripting of events, objects and actions to create Internet application. JavaScript was created by Netscape. It preceded the European Computer Manufacturers Association (ECMA) standard and is the first Web Scripting language. It is syntactically identical to Java, which in turn is based on C++.

Microsoft's version is called JScript. Netscape, Microsoft, and other companies are cooperating with the ECMA to produce a universal, client-side scripting language, the current version of which is referred to as ECMA-262. JavaScript and JScript each conform to this standard.

With JavaScript, new dynamic elements let developers go beyond the simple click and wait. Users will not just read the pages but also interact with them. Even with the slowest Internet connection, users will get quick responses because the interaction does not need to involve the server but can take place in their browser.

ii) VBScript

Visual Basic Script or also known as VBScript is a subset of Microsoft Visual Basic used in World Wide Web HTML documents to enhance the functionality of a Web page displayed in a web browser. Microsoft's Internet Explorer Web Browser contains a VBScript scripting engine (i.e. an interpreter) that executes VBScript code. VBScript can also be executed in other Web Browser through plug-in technologies.

VBScript can be very useful because many company Internets tend to standardize on a particular Web Browser, and, if that browser is Internet Browser, the VBScript techniques can readily be used on client side to enhance HTML documents. Second, VBScript is particularly valuable when used with Microsoft Web server to create Active Server Pages (ASP) – a technology that allows a server-side script to create dynamic content that is sent to the client's browser. Although other scripting languages can be used, VBScript is the de facto language for ASP.

2.5.3 Server Side Software Development Paradigms

i) Active Server Pages (ASP)

The Active Server Pages (ASP) is a server-side text file that is processed in response to client (e.g. a browser) request. ASP is a Microsoft-developed technology for sending dynamic Web content (includes HTML, Dynamic HTML, ActiveX control, client-side scripts and Java applets) to the clients. An ASP file has .asp as file extension. Although other languages such as JavaScript can be used for ASP scripting, VBScript is the de facto language for ASP scripting.

When a client sends HTTP request to the server, the server receives the request and directs it to be processed by the appropriate Active Server Pages. The ASP does its processing (which often includes interacting with a database), then return its result to the client – normally in the form of a HTML document to display in a browser. Other data formats, such as images and binary data, can be returned.

ii) Servlets

Servlets are the analog on the server side to applets on the client side and are similar to ASP and CGI. Servlets are normally executed as part of a web server. In fact servlets have become so popular that they are now supported by most major web servers, including Microsoft's Internet Information Server (though a web server plug-in such as Allaire Corporation JRun), the Netscape web servers, the World Wide Web Consortium's Java-based Jigsaw Web Server, Sun Microsystem's Java Web Server and the popular Apache Web Server.

Servlets technology today is primarily designed for use with the HTTP protocol of the World Wide Web. A client sends request to the server via the HTTp. The server receives the request and directs it to be processed by appropriate servlets. The servlets do their processing (which often includes interacting with a database), then return their results to the client – normally in the form of HTML documents to display in browser, but other data formats, such as images, binary data and XML, can be returned.

Servlets are efficient for developing web-based solutions that help provide secure access to a web site, that interact with databases on behalf of client, that dynamically generate custom HTML documents to be displayed by browser and that maintain unique session information for each client. Many developers feel that servlets are the right solution for database-intensive application that communicates with so-called thin-clients – application that requires minimal client-side support. The server is responsible for the database access. Clients connect to the server using standard protocols available on all platforms. Thus, the logic code can be written once and reside on the server for access by clients.

iii) Common Gateway Interface (CGI)

The Common Gateway Interface (CGI) lets HTTP clients interact with programs across a network through a web server. CGI is standard for interfacing applications with a web server. CGI applications can be written in many different programming languages. Permission is granted within the web server by a web master (or the author of the web site) to allow specific programs to be executed on the web server. Typically, CGI application reside in the directory /cgi-bin/.

When a web browser takes information from a user (usually by means of an HTML form) and sends it, using HTTP, to a web server, a server-side CGI program is then executed to process the information and sends back the information to the client. The information sent to the client is typically HTML web page, but may contain images, it cannot be directly programmed – a script or executable program must be used to interact with it. Perl is a popular language to use with CGI.

Perl (Practical Extraction and Report Language) is a high level programming language developed by Lary Wall in 1987 while working at Unisys. Wall's initial intent was to create a programming language to monitor large software projects and generate reports. Perl has particularly rich, easy to use text-processing capabilities. Perl is an alternative to UNIX shell scripts.

As the web increased in popularity, it became evident that the ability for the user to interact with the server would be crucial. The true power of the web lay not only in serving content but also in responding to requests from users and generating dynamic content. The frame \work for such communication already existed through CGI. Because most of the information users send to server is text – such as user names, passwords, and email addresses – Perl was the logical choice for programming the server side of interactive web-based applications and is the most popular language for doing so today.

The Perl community continuously corrects problems that appear and evolves the language to keep it competitive with newer server-side technologies such as Microsoft ASP and Sun Microsystem's Java Servlets. Although Perl was initially developed on the UNIX platform, it was always intended to be a cross-platform computer language.

iii) ColdFusion

Back in the early ColdFusion days, ColdFusion was a CGI script. Every time a user would make a ColdFusion request (displaying data or inserting and updating records), the web server executed the entire ColdFusion program. Cold Fusion would process the user's request, perform whatever actions were necessary, and return HTML output to user. The Allaire development team broke ColdFusion into multiple parts:

- ✓ The guts of ColdFusion, the engine that actually processes the user's requests, became a Windows NT service and a UNIX daemon. As a service, ColdFusion can remain running not support services, this engine is a separate application that remains running at all times.
- ✓ Web servers themselves have no idea how the communicate with a service or daemon, so server modules were written for the four different server APIs. These server modules are the glue that binds the web server to the ColdFusion service.
- ✓ A CGI script (cfml.exe) was created for web servers that don't support server APIs. This CGI script guarantees that any web server that supports the CGI specification can be used with ColdFusion. Of course, the CGI script interface to ColdFusion is slower than the server API interfaces, so it should only be used when the server modules cannot.

ColdFusion is a rapid application development tool that enables the rapid creation of interactive, dynamic, and information-rich web sites. ColdFusion does not require coding in traditional programming languages, but the traditional programming constructs and techniques are fully supports. After create the applications by extending the standard HTML files with high-level formatting functions, conditional operators, and database commands, these commands will instructions to the ColdFusion processor and form the building blocks on which to build industrial-strength application.

This method of creating web application has significant advantages over conventional application development. [9]

- ✓ ColdFusion application can be developed rapidly because no coding, other than use of simple HTML style tags, is required.
- ✓ ColdFusion applications are easy to test and roll out.
- ✓ The ColdFusion language contains all the processing and formatting functions.
- ✓ ColdFusion applications are easy to maintain because there is no compilation or linking step.
- ✓ ColdFusion provides all the tools to troubleshoot and debug application, including a powerful remote interactive debugger.

2.5.5 Web application development tools

2.5.5.1 Visual InterDev

Visual InterDev is Microsoft's development tool for building a dynamic, data-driven Web site. Visual InterDev is a software package that combines a powerful HTML WYSIWYG (what you see is what you get) editor with a thorough source-editing interface that will simplify all the coding. Using Visual InterDev, one can assemble pages that use Microsoft's ActiveX technologies, including Active Server Page (Active Server Page) technology. The developer can build and insert ActiveX control or Java applet. Visual InterDev includes an HTML editor and support for dynamic HTML. The Web site can be integrated with server programs written in any language and access to almost any database

using Microsoft's Universal Data Access, including ActiveX Data Objects, Open Database Connectivity, and OLE DB. [3]

2.5.5.2 Macromedia Flash

Macromedia Flash is the key to designing and delivering low-bandwidth animations, presentations, and Web sites. It offers scripting capabilities and server-side connectivity for creating engaging applications, Web interfaces, and training courses. Integration between Dreamweaver and Macromedia Flash enables users to easily integrate vector animations, MP3 audio, and interactivity to produce high-impact, engaging Web applications. [10]

2.5.5.3 Macromedia Fireworks

Macromedia Fireworks is the solution for professional Web graphics design and production. Macromedia Fireworks enable user to create, edit, and animate Web graphics using a complete set of bitmap and vector tools. Use export controls to optimize user's images, give them advanced interactivity, and export them into Macromedia Dreamweaver and other HTML editors. With Fireworks, they can produce graphics in Fireworks, and seamlessly integrate them into Dreamweaver using Round-trip Graphics Editing. [10]

2.5.5.4 Macromedia Dreamweaver 4

Macromedia Dreamweaver 4 has everything for users to develop a professional Web site. Users can build Macromedia Flash graphics directly in Dreamweaver. Whether users use Dreamweaver's visual layout tools or its text-editing environment, the intuitive Macromedia User Interface makes it easy. [10]

2.5.5.5 Microsoft Front Page

Ms front page add value to creating Web application by adding the visual components that's are missing from Visual Interdev. Ms front page enable users to quickly generate HTML and save a lot of time and frustration spent on getting cornplicated HTML page layout properly adjusted. After the page is created, users can edit the HTML source code to create the dynamic content on the page while relying on the HTML tags to quickly generate the look and feel of the page. [11]

2.5.6 Operating System Platform

An operating system (OS) is the program that, after being initially loaded into the computer by a bootstrap program, manages all the other programs in a computer. The other programs are called applications. The applications make use of the operating system by making requests for services through a defined application program interface (API). In addition, users can interact directly with operating system through an interface such as a command language. An operating system performs these services for applications:

- ✓ In multitasking operating systems where multiple programs can be running at the same time, the operating system determines which applications should run in what order and how much time should be allowed for each application before giving another application a turn.
- ✓ It manages the sharing of internal memory among multiple applications.
- ✓ It handles input and output to and from attached hardware, such as hard disks, printers, and dial-up ports.
- ✓ It sends messages to the applications or interactive user (or to a system operator) about the status of operation and any errors that may have occurred.
- ✓ It can offload the management of what are called batch jobs (for example, printing) so that the initiating application is freed from this work.
- ✓ On computers that can provide parallel processing, an operating system can manage how to divide the program so that it runs on more than one processor at a time.

All major computer platforms (hardware and software) require and sometimes include an operating system. UNIX, Windows 98/NT, DEC's VMS, IBM's OS/2, AIX, and OS/390 are all examples of operating systems.

2.5.6.1 Windows NT 4.0

Windows NT was developed from the ground up by Microsoft as an entirely new operating system, based on 32-bit code that is free from the limitations of MS-DOS or 16-bit Windows. The Microsoft development team, led by Dave Cutler (a former Digital

Equipment Corporation employee and designer of Digital's VAX/VMS operating system), designed the Windows NT operating system with following design goals:

- ✓ Reliable: Windows NT had to be extremely stable and not let misbehaving applications interface with the operating system's core services.
- ✓ Performance: Windows NT had to be fast – it had to use only 32-bit code and utilize system resources more efficiently than previous versions of Windows.
- ✓ Portability: Windows NT had to be portable to different hardware platforms based on entirely different processor. To achieve this level of portability, Windows NT was designed in a modular fashion without the use of assembly language, a processor-specific language used in previous operating systems (mainly to improve performance). Apart from a small, hardware-specific element known as the Hardware Abstraction Layer (HAL), most of the operating system is written in C to facilitate portability.
- ✓ Compatibility: Windows NT had to be compatible with the majority of existing applications on the market. Specifically, it would contain separate application subsystems (or environments), each providing support for a different type of application. Initially, this support would include MS-DOS, 16-bit Windows, 32-bit Windows, POSIX, and OS/2 1.x character-mode applications. Windows NT had to be expandable to support future applications as well.
- ✓ Scalability: Windows NT had to be scalable; that is , it had to be able to take advantage of increased hardware resources in larger, more powerful systems without having to be rewritten. For example, on a multiprocessor system, Windows NT would have to divide tasks evenly across all processor to optimize the speed of system operations.
- ✓ Security: Windows NT had to incorporate security features required by the U.S. government and large businesses. These security features include such items as an encrypted security database, permissions at the file level and the user level, and a sophisticated user database design that would scale to the enterprise level. IN particular, Windows NT needed to be a Class C2-certifiable operating system, the minimum-security rating required by the U.S government for internal use.

2.5.6.2 UNIX

UNIX is an operating system that originated at Bell Labs in 1969 as an interactive time-sharing system. Ken Thompson and Dennis Ritchie are considered the inventors of UNIX. The name was a pun based on an earlier system, Multiplexed Information and Computing Se. In 1974, UNIX became the first operating system written in the C language. UNIX has evolved as a kind of large freeware product, with many extensions and new ideas provided in a variety of versions of UNIX by different companies, universities, and individuals. Partly because it was not a proprietary operating system owned by any one of the leading computer companies and partly because it is written in a standard language and embraced many popular ideas, UNIX became the first open or standard operating system that could be improved or enhanced by anyone.

UNIX operating systems are used in widely sold workstation products from Sun Microsystems, Silicon Graphics, IBM, and a number of other companies. The UNIX environment and the client/server program model were important elements in the development of the Internet and the reshaping of computing as centered in networks rather than in individual computers. Linux, a UNIX derivative available in both "free software" and commercial versions, is increasing in popularity as an alternative to proprietary operating systems. [3]

2.5.6.3 Windows 2000

Windows 2000 (W2K) is the latest commercial version of Microsoft's evolving Windows operating system. Previously called Windows NT 5.0, Microsoft emphasizes that Windows 2000 is evolutionary and "Built on NT Technology." Windows 2000 is designed to appeal to small business and professional users as well as to the more technical and larger business market for which the NT was designed. For many Windows 95 and Windows 98 users, Windows 2000 may be regarded as a step to take when purchasing their next computer.

The Windows 2000 product line consists of four products:

- ✓ Windows 2000 Professional, aimed at individuals and businesses of all sizes.
- ✓ Windows 2000 Server, aimed at small-to-medium size businesses.
- ✓ Windows 2000 Advanced Server, aimed at being a network operating system server and/or an application server, including those involving large databases.
- ✓ Windows 2000 Datacenter Server, designed for large data warehouses, online transaction processing (OLTP), econometric analysis, and other applications requiring high-speed computation and large databases.

Windows 2000 is reported to be more stable (less apt to crash) than Windows 98/NT systems. A significant new feature is Microsoft's Active Directory, which, among other capabilities, enables a company to set up virtual private networks, to encrypt data locally or on the network, and to give users access to shared files in a consistent way from any network computer. [12]

2.5.7 Web Client (Browser)

A web client also known as browser is an application program that provides a way to look at and interact with all the information on the World Wide Web. The word "browser" seems to have originated prior to the web as a generic term for user interfaces that let user browse text files online. By the time the first web browser with a graphical user interface was invented (Mosaic, in 1992), the term seemed to apply to web content, too. Technically, a web browser is a client program that uses the Hypertext Transfer Protocol (HTTP) to make requests of web servers throughout the Internet on behalf of the browser user. A commercial version of the original browser, Mosaic is in use. Many of the user interface features in Mosaic; however, went into the first widely used browser, Netscape Navigator. Microsoft followed with its Internet Explorer. Today, these two browsers are highly competitive and the only two browsers that the vast majority of Internet users are aware of.

2.5.7.1 Microsoft Internet Explorer

Internet Explorer makes it easier to get the most from the World Wide Web, whether you are searching for new information or browsing your favorite web sites. And built-in IntelliSense technology can save you time completing routine web tasks, such as automatically completing web addresses and forms for you, and automatically detecting your network and connection status.

2.5.7.2 Netscape Navigator

Netscape Navigator is one of the two most popular web browsers and also the name of a company, Netscape Communications, now owned by America Online (AOL). Netscape was initially the predominant product in terms of usability and number of users. Netscape's browser originally was called "Navigator", and is still called that in the suit of software, Communicator, of which it is now a part. Navigator was developed in 1995 by a team led by Marc Andersen, who created Mosaic, the first web browser that had a graphical user interface, at the University of Illinois' National Center for Supercomputing Application (NCSA) in 1993.

A primary source of revenue for Netscape and AOL is the Netscape line of web server products that it develops and has marketed on the success of its wide-scale browser usage. Netscape and AOL also envision the Netscape web site, now transformed into a leading web portal, as a leading source of revenue through advertising and e-commerce. [3]

2.5.8 Web Database Management System

2.5.8.1 Relational Database

A database is a collection of data that is organized so that its contents can easily be accessed, managed, and updated. The most prevalent type of database is the relational database, a tabular database in which data is defined so that it can be reorganized and accessed in a number of different ways. Databases contain aggregations of data records or files, such as sales transactions, product catalogs and inventories, and customer profiles. A

language called Structured Query Language (SQL-pronounced "sequel") is almost universally used with relational database systems such as IBM's DB2, Microsoft's Access, and database products from Oracle, Sybase, and Computer Associates to make queries and manipulate data.

2.5.8.2 SQL- Structured Query Language

SQL provides a complete set of keywords that enable programmers to define complex queries that select data from a table. The results of a query are commonly called result sets (or record sets). Others users of a database wish to combine smaller tables into larger ones to produce more complex result sets. The combination operation is called join (specify with INNER JOIN in SQL). There are several dialects of SQL that exits in the market, a programmer should be aware of the difference. However, the difference is not great and the basic principles in using SQL can still be applied.

2.5.8.3 MySQL

MySQL is an open source relational database management system (RDBMS) that uses Structured Query Language (SQL), the most popular language for adding, accessing, and processing data in a database. Because it is open source, anyone can download MySQL and tailor it to their needs in accordance with the general public license. MySQL is noted mainly for its speed, reliability, and flexibility. Most agree, however, that it works best when managing content and not executing transactions.

The MySQL relational database system was first released in January 1998. It is fully multi-threaded using kernel threads, provides application program interfaces (APIs) for C, C++, Eiffel, Java, Perl, PHP, Python, and Tcl, allows for many column types, and offers full operator and function support in the SELECT and WHERE parts of queries.

MySQL currently runs on the Linux, UNIX, and Windows platforms. Many Internet startups have been especially interested in MySQL as an alternative to the proprietary database systems from Oracle, IBM, and Informix. Yahoo's news site uses MySQL. [3]

2.5.8.4 Oracle

Oracle8i is the most complete and comprehensive platform for development and development of the Internet applications. It simplifies the development of applications, the management of the Internet content, and the development of applications. As the lowest cost development and development platform, Oracle8i is the platform for enabling business on the Internet.

Oracle relational database technology is already the foundation of the Internet. Every major web site uses Oracle; 67 percent of the most popular e-commerce web sites; and 100 percent of the top ten e-commerce sites. Now with Oracle8i, Oracle is evolving from and Enterprise-capable relational database to a data-centric Internet application platform. Oracle8i is designed for: developing Applications for the Internet. [8]

- ✓ Developing Applications for the Internet.
- ✓ Managing Internet Content
- ✓ Enabling Business Online

Oracle8i is the most complete and comprehensive platform in the market for development and deployment of the Internet applications. Oracle8i is also the lowest cost development and deployment platform, making it the platform to choose for enabling business on the Internet. [8]

2.5.8.5 Microsoft SQL

Microsoft SQL Server is a scalable, high performance database management system designed specially for distributed client/server application. Microsoft SQL server provides tight integration with Windows and Windows-based applications. Microsoft is ideal for powering Web sites. Through tight integration with Internet Information Server, SQL Server can be queried and updated via popular web browser.

SQL Server provides agility to users data management and analysis, allowing user's organization to adapt quickly and gracefully to derive competitive advantage in a fast-changing environment. From a data management and analysis perspective, it is critical to turn raw data into business intelligence and take full advantage of the opportunities

presented by the Web. A complete database and data analysis package, SQL Server opens the door to the rapid development of a new generation of enterprise-class business applications that can give user's company a critical competitive advantage. The record-holder of important benchmark awards for scalability and speed, SQL Server is a fully Web-enabled database product, providing core support for Extensible Markup Language (XML) and the ability to query across the Internet and beyond the firewall.

SQL Server provides extensive database programming capabilities built on Web standards. Rich XML and Internet standard support give users the ability to store and retrieve data in XML format easily with built-in stored procedures. Users can also use XML updategrams to insert, update and delete data easily. [12]

2.5.8.6 Microsoft Access

Microsoft access (the most current version is Office XP) is a relational database management system (RDBMS) designed for small companies and personal use. It utilizes Microsoft Jet Engine. Access is very user-friendly and has simple application creation and report generating tools.

2.5.9 Web database connectivity

2.5.9.1 Data Access Objects

DAO (Data Access Objects) is an application program interface (application program interface) available with Microsoft's Visual Basic that lets a programmer request access to a Microsoft Access database. DAO was Microsoft's first object-oriented interface with databases. DAO objects encapsulation Access's Jet functions. Through Jet functions, it can also access other Structured Query Language (Structured Query Language) databases. [3]

2.5.9.2 ActiveX Data Objects

ActiveX Data Objects (ADO) is an application program interface from Microsoft that lets programmers writing Windows applications get access to a relational or non-relational database from both Microsoft and other database providers. For example, if users wanted to write a program that would provide user's Web site with data from an IBM DB2 database or an Oracle database, users could include ADO program statements in an HTML file that users then identified as an Active Server Page. When a user requested the page from the Web site, the page sent back could include appropriate data from a database, obtained using ADO code.

Like Microsoft's other system interfaces, ADO is an object-oriented programming interface. It is also part of an overall data access strategy from Microsoft called Universal Data Access. Microsoft says that rather than try to build a universal database as IBM and Oracle have suggested, why not provide universal access to various kinds of existing and future databases? In order for this to work, Microsoft and other database companies provide a "bridge" program between the database and Microsoft's OLE DB, the low-level interface to databases. OLE DB is the underlying system service that a programmer using ADO is actually using. [3]

2.5.9.3 Remote Data Objects

RDO (Remote Data Objects) is an application program interface (application program interface) from Microsoft that lets programmers writing Windows applications get access to from both Microsoft and other database providers. In turn, RDO statements in a program use Microsoft's lower-layer Data Access Objects (Data Access Objects) for actual access to the database. Database providers write to the DAO interface.
RDO has evolved into ActiveX Data Objects (ActiveX Data Objects), which is now the program interface Microsoft recommends for new programs. [3]

2.5.9.4 Open Database Connectivity

Open Database Connectivity (ODBC) is an open standard application-programming interface (API) for accessing a database. By using ODBC statements in a program, users can access files in a number of different databases, including Access,

dBase, DB2, Excel, and Text. In addition to the ODBC software, a separate module or driver is needed for each database to be accessed. The main proponent and supplier of ODBC programming support is Microsoft.

ODBC is based on and closely aligned with The Open Group standard Structured Query Language (SQL) Call-Level Interface. It allows programs to use SQL requests that will access databases without having to know the proprietary interfaces to the databases. ODBC handles the SQL request and converts it into a request the individual database system understands. [3]

2.6 Chapter Summary

Chapter 2, Literature Review listed down all the related issue about the system. It shows the research steps in gathering hard data, analysis and synthesis process. It includes information about MPC, Paralympic sport, Paralympic sport management, steps in organizing a Paralympic game, and computer technology that may be choose for develop the system. It also includes the analysis on existing system and comparison between PSMS and existing system. The existing systems are current system in Sport Science Center, current system in MPC and a Paralympic sport management system done by FSKTM diploma student.

Chapter 3: Methodology

~V Model
~ Requirement Analysis
~ Development Environment
~ Run Time Requirements
~Chapter Summary

Chapter 3: Methodology

3.1 V Model

The process model that used to develop PSMS is V model. The V model is a variation of the waterfall model. Waterfall model is the earliest model and is derived from the hardware world, presenting a manufacturing view of software development. Thus, this model is failure to treat software as a problem-solving process and provides no guidance to handle changes occur during development. In waterfall model, the stages are depicted as cascading from one to another. This means, one development stage should be completed before the next begins.

V model demonstrates how the testing activities are related to analysis and design as shown in figure below, coding forms the point of the V, with requirement analysis, system design and program design on the left, unit & integration testing, system testing, acceptance testing and operation & maintenance on the right. Unit and integration testing will addresses the correctness of programs. The V model suggests that unit and integration testing also be used to verify the program design. That is, during unit and integration testing, the developer should ensure that all aspects of the program design have been implemented correctly in the code. Similarly, system testing should verify the system design, making sure that all system design aspects are correctly implemented. Acceptance testing, which is conducted by the customer rather than the developer, validates the requirements by associating a testing step with each element of the specification; this type of testing checks to see that all requirements have been fully implemented before the system is accepted.

The model's linkage of the left side with the right side of the V implies that if problems are found during verification and validation, then the left side of the V can be re-executed to fix and improve the requirements, design, and code before the testing steps on the right side are reenacted. In other words, the V model makes more explicit some of the iteration and rework that are hidden in the waterfall depiction. Whereas the focus of the

waterfall is often documents and artifact, the focus of the V model is activity and correctness. [13]

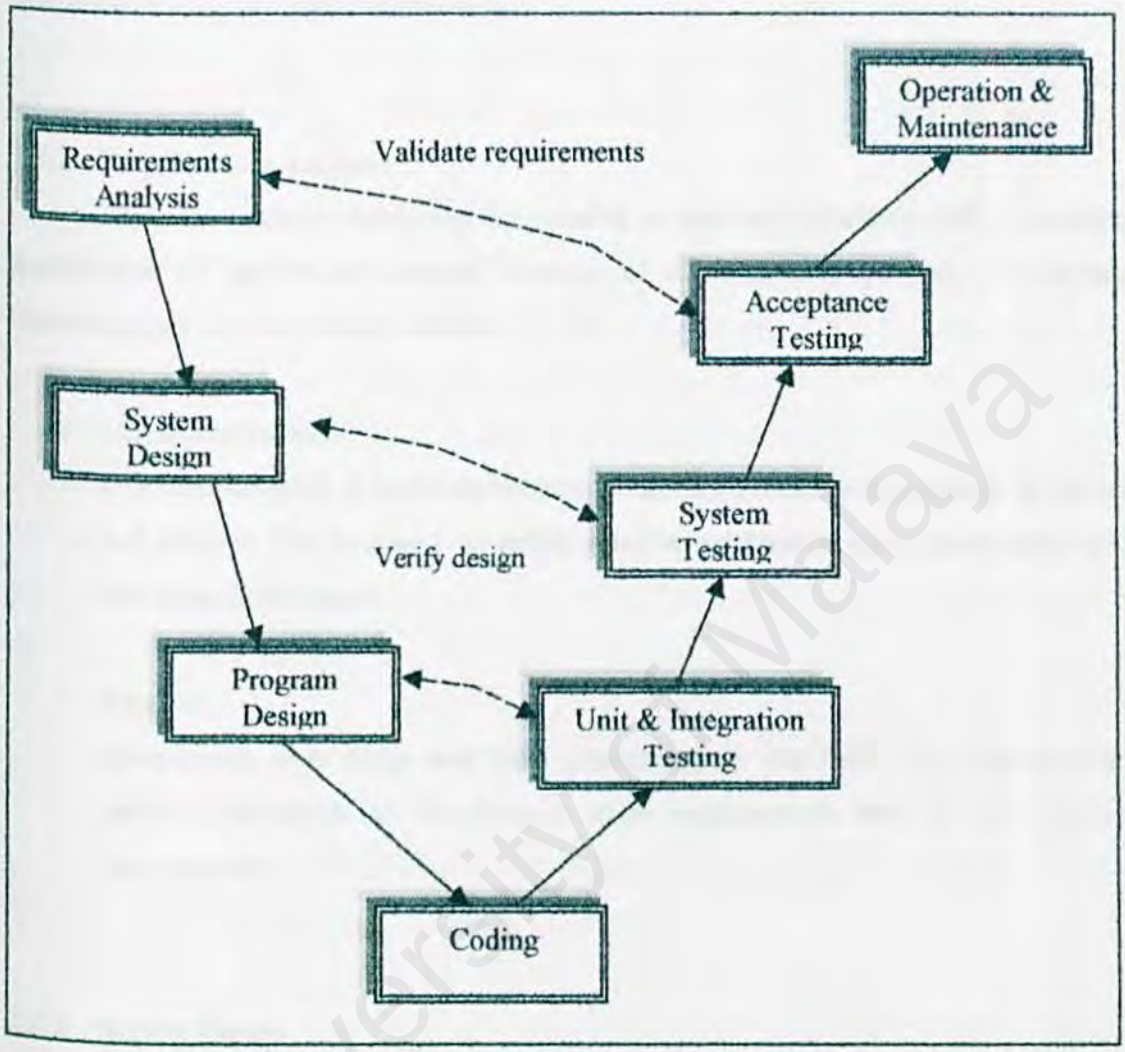

Figure 3.1: The V model

3.1.1 Why V model?

V model is a variation of the waterfall model that reduces the weaknesses in waterfall model. V model provides guidance to handle changes to system and activities that are likely to occur during development. For example, when requirements change during certain stage, it is necessary to return to the requirements stage to update the system requirement specification. This model contains validate requirements and verify design

functions to ensure all elements in every stages are performed correctly. With V model, developer able to minimize the mistakes in system development and make sure the client's requirement have been fully implemented.

3.1.2 Requirement Analysis

This stage includes analyzing the problem at hand and concludes with a complete specification of the desired external behavior of the system to be built. To capture requirements, this are the steps involved:

- ✓ Literature Research

  Literature research is based on books, journals and reference materials from library and Internet. The purpose is to gather detail information in sport management and computer technologies.

- ✓ Interview

  Interviewees were those who have experiences in this field. The purpose is to gather information in Paralympic sport management and to get client's requirements.

3.1.3 System Design

This stage decomposes the software system into its actual constituent (architectural) components and then iteratively decomposes those components into smaller and smaller subcomponents until the subcomponents located at the leaves of the resulting design tree are small enough so that we would expect a person to be able to 'get his or her arms around it' easily.

3.1.4 Program Design

Defines and documents algorithms for each module in the design tree that will be realized as code.

3.1.5 Coding

Transforms algorithms defined during the detailed design stage into a computer-understandable language. This is usually performed in two steps: converting the algorithm into high-level language (usually performed by people) and converting the high level language into a machine language (usually performed automatically by a compiler.

3.1.6 Unit & Integration Testing

Checks each coded module for the presence of bugs. Unit & integration testing's purpose is to ensure that each as-built module behaves according to its specification defined during detailed design. This stage also will interconnect sets of previously tested modules to ensure that the sets behave as well as they did as independently tested modules. Ideally each set of modules should correspond to a component in the design tree defined during unit testing. Thus, this will ensure that each as-built component behaves according to its specification.

3.1.7 System Testing

System testing will checks that the entire system embedded in its actual hardware environment behave according to system requirements

3.1.8 Operation & Maintenance

After final system testing, the system and its surrounding hardware become operational. The maintenance process is actually a full development life cycle, if a coding change is made, then the design, coding, and three testing stage must be performed. If a requirement change has occurred, then all the stages must be performed.

3.1.9 Verify Design

Ensure the every unit, integration part and system meets its contents to reduce error during system development.

3.1.10 Validate Requirements

Ensure every client's requirements have been correctly implemented before the system is accepted.

3.2 Requirement Analysis

Requirement analysis covers 2 main categories, which are:

- ✓ Functional Requirement
- ✓ Non-Functional Requirement

3.2.1 Functional Requirement

Functional requirement describe an interaction between the system and its environment. The functional requirement also explains how the system should behave given certain stimuli.

General Section:

- ✓ Security Module

  This module prevents unauthorized administrator and assistant administrator to login and change the database. This module requires username and password from administrator to protect the database system.

Administration Section:

This section has been separate to two main sections, administrator section and assistant administrator section. The administrator is the person who has permission to access the full entire database in PSMS. While assistant administrator refer to those who can only access one of the module in PSMS. This means the administrator will create a database that will be divided to parts (or modules) that will be handled by assistant administrator. The assistant administrator then will key in the information for every module in PSMS.

i) Administrator Section:

- ✓ New Game Module

This module creates a new game or sport event organized by MPC. The administrator needs to create a database for a new game. This database refers to the database that contains all other modules' data listed below.

ii) Assistant Administrator Section:

✓ Committee Module

The module contains the committee structure (or organization team) for a game and members' detail in every sub committee. For every new game, it will contains only one committee structure and the members' detail will be key in by administrator.

✓ Volunteers Module

This module contains the management of the volunteers. This module will let the assistant administrator to key in the volunteers' detail information and their position.

✓ Event Schedule Module

This module will manage the timetable or schedule for every game. The records can display according to date and location.

✓ Event Result Module

Event result module was divided to two sub modules. The first module is participated country sub module and the second module is event result sub module. The participated country sub module contains a new form for assistant administrator to fill in the participated countries name and detail. After assistant administrator enters all the countries' name, then the assistant administrator are allowed to access event result module. It is because the event result module needs the records from participated countries module. In event result module, the assistant administrator needs to key in the winners for each game and their country's name. The country's name only can be found after the assistant administrator update the participated country module. Besides that, in this module, medals table will be generated for every game.

✓ Technical Competition Module

This module contains the result for every game type in a sport event, technician and officers' detail, and the list of equipments.

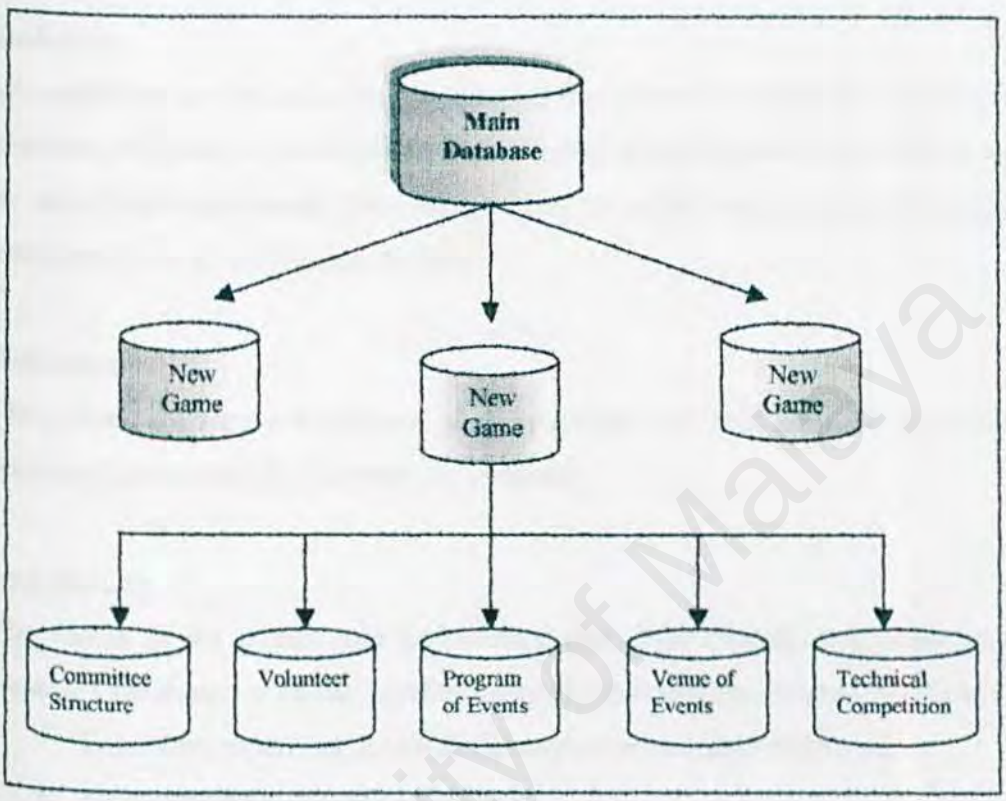

Figure 3.2: Administration Section

User Section:

Users are able to access the system, they allow reading the information through this system but they don't have permission to change or edit information from database. The module that provided by this system for the users is Search Module to search records from database.

The structure for all these modules will be shown in chapter 4.2, **PSMS Module Structure**.

3.2.2 Non-Functional Requirement

Non-functional requirements are defined as constraints under which the system must operate and the standard, which must be met by the delivered system.

Scalability

The scalability is to promise the capability of the system to migrate as a client or server to machines of greater or lesser power, depending upon requirements, with little or no change to underlying components. The solution can be scaled using hardware or application configuration or a combination of them.

Reliability

The system, software and hardware shall be reliable and shall not cause unnecessary and unplanned downtime of the overall environment.

User friendly

The design of the system and its interface should be friendly and easily understood. Generally the design of all the interfaces should confirm to the following criteria:

- ✓ Consistent, in term of screen design and error messages displayed
- ✓ Accommodation of any level of user
- ✓ Appropriate error handling with associated error messages
- ✓ High degree of understandability and avoid too much memorization of event and commands

Efficiency

Efficiency in computer technology means a process or procedure that can call or accessed in an unlimited of times to produce similar outcomes or output at a creditable speed.

Manageability

The sections within the system should be easy to handle to ensure the maintenance can be done regularly.

Modularity

Modularity is a key in order to produce a good program. The system is broken into sections or modules so that functions of objects could be distinct from one another. This characteristic eases the testing and maintenance.

3.3 Development Environment

After information gathering and analysis processes, the most suitable tools for the system have been decided. These tools include the entire platform, servers, web application programming language and technology.

3.3.1 Web Application Programming Language and Technologies

Active Server Page (ASP)

ASP is the script that runs in Microsoft Web Server. ASP has been chosen as server-side scripting for this project because of its simplicity and speed. Compared to CGI, ASP is easier to use and is more flexible in changing codes as no compilation involved. Thus, ASP takes less time to write and debug. ASP is suitable for building multi-tier Internet or Intranet application and it can minimize network traffic by limiting the need for the browser and server to talk each other. It also provides improved security measures since the code can never be viewed from the browser.

HTML (Hypertext Markup Language)

HTML is the basic language for the web pages. HTML is necessary for the development of client's browser run script. HTML is easy to implement and needed to generate layout and design for web page.

VBScript (Visual Basic Script)

VBScript is the basic server side scripting language for ASP. It is a subset of VB language. Its function is to make web pages more dynamic and it is better support than JavaScript when it is used in ASP environment.

3.3.2 Development Environment Tools

Platform: Windows 2000

Windows 2000 has been chosen as main server operating system. It is chosen because of its user friendliness and stability feature. Windows 2000 is graphical user interface, thus it is simple to used and quicken the learning process. Windows 2000 supports the usage of the other Microsoft server technologies that will be used. It combines the best aspects of an application server, a file and printer server, a communications server, and a web server, along wit interoperability and management features that make it an excellent network operating system for all level users. The combination of Windows 2000 and its built-in web server provides faster performance.

Web Server: Internet Information Server 4.0 (IIS 4.0)

Since Windows 2000 will be used as the platform for this system, IIS 4.0 would seem to be a better choice because it can be well supported by Windows 2000 operating system and provides higher performance on Windows 2000. Beside, IIS 4.0 can provide the basic web authentication for the web application.

Database System: Microsoft SQL Server 7.0

It was chosen as systems database platform because it is stable and work well with other Microsoft components. SQL Server is more easy to use compared to Oracle because it provides graphical tools for installation, configuration and administration. It supports multi-user environment and it can handle more burden of database processing even in a distributed environment. Compared to Microsoft Access 2000, SQL Server works well with database of any size. While, Access 2000 is suitable to use with small to medium-sized databases.

Microsoft Visual Interdev 6.0

Microsoft Visual Interdev is the editor for the ASP coding. It provides more features that are helpful for ASP coding. The graphical design can be drawn easily by using Microsoft Visual Interdev 6.0. It also provides the script outline as well as the toolbox and server object that minimizes the burden to build a web application.

Web Browser:

Internet Explorer 4.0 and above (IE 4.0)

IE is the most suitable browser for the system compare to others. Internet Explorer is needed for this web application system because it supports most of the HTML scripts that are used in this system.

Netscape Navigator 4.6 and above

Netscape Navigator is also been chosen as the browser for this system. It is needed for this web application system because it is one of the major browser for web site.

3.4 Run Time Requirements

3.4.1 Server Hardware Requirements

The server computer requirements are:

- ✓ At least Pentium 166 MHz Processor
- ✓ 128MB Ram or higher
- ✓ 2 GB free hard disk space
- ✓ Network Interface Card (NIC) and network connection with recommended bandwidth at 10Mbps or more
- ✓ Other standard computer peripherals

3.4.2 Server Software Requirements

To host and run the system, the server computer needs to have various supporting software installed:

- ✓ Microsoft Windows NT Server 4.0
- ✓ Microsoft Internet Information Server 4.0 (Bundled with Windows NT 4.0)
- ✓ Microsoft SQL Server 7.0

3.4.3 Client Hardware Requirements

- ✓ Any compatible PC with recommended at least 486 processor
- ✓ 8 MB RAM or higher

- ✓ At least 20 MB of hard disk space
- ✓ At least 10 bps network card

3.4.4 Client Software Requirements

- ✓ Windows based Operating System
- ✓ Internet Explorer 4.0 and above

3.5 Chapter Summary

Chapter 3, Methodology shows the V model, which is the process model that has been chosen to develop this system. Besides, it also includes the functional requirement, non-functional requirement, development environment, and run time requirement. This chapter gives detail information in client's requirement and development tools. The functional requirement will mention the modules that provided by PSMS. It has been divided to the section: administrator section, assistant administrator section and user section. The administrator section contains two modules: New game module and committee module. The assistant administrator section contains four modules: volunteer module, program of event module, program of venue module and technical competition module. While the user section contains only one module, which is the search module.

Chapter 4: System Design

~System Architecture
~PSMS Module Structure
~Entity-Relational Diagram
~Data Flow Diagram (DFD)
~ User Interface Design
~ Database Design
~Chapter Summary

Chapter 4: System Design

4.1 System Architecture

System architecture shows the general structure for PSMS, which is Three-Tier Client/Server Architecture:

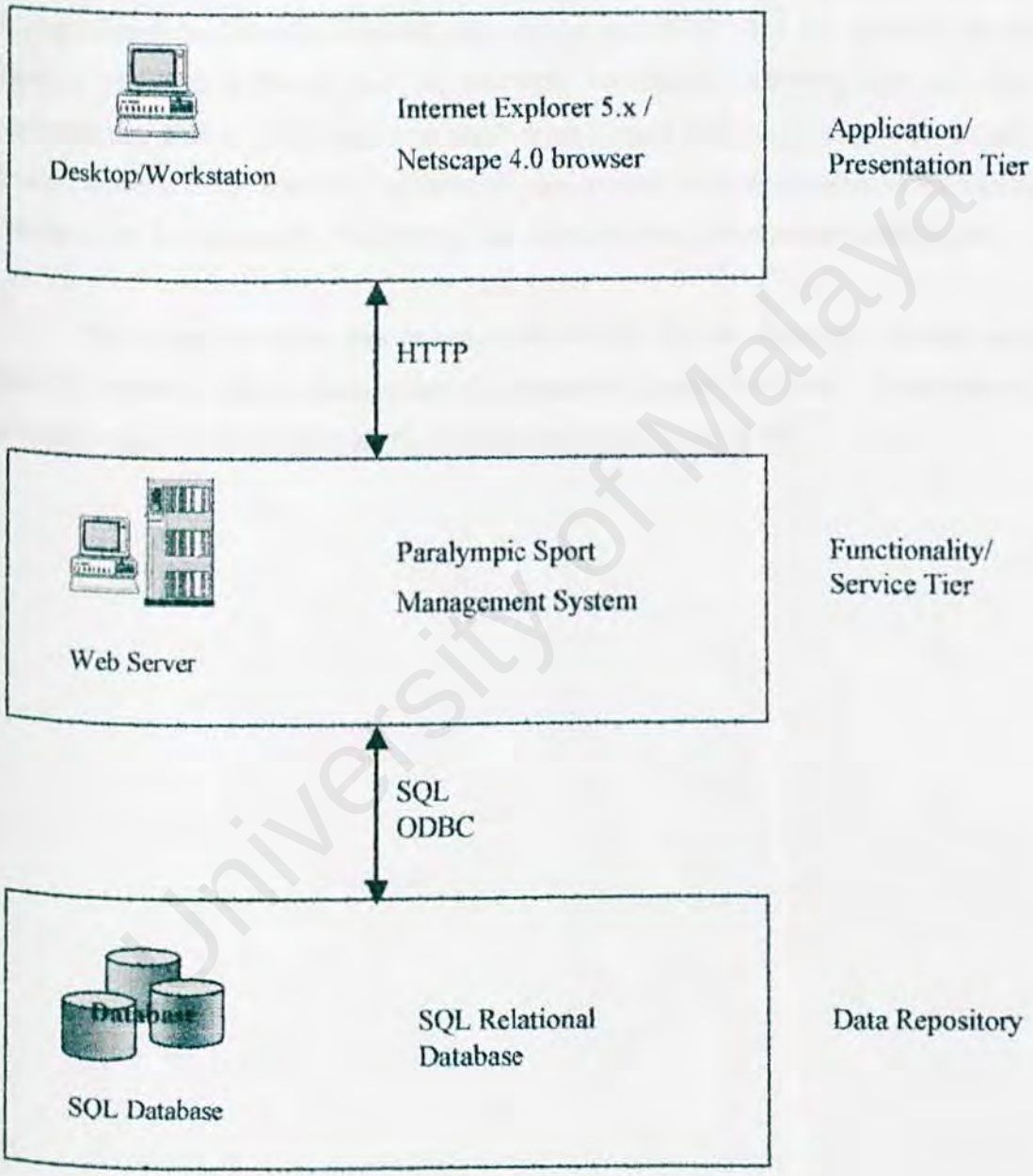

Figure 4.1: Three-Tier Client/Server Architecture

Application/presentation tier provides user interface for users and administrator through the web browsers. The application will always resides within the web server, which is the IIS 4.0.

The second tier is functionality or server tier. It communicates with the first tier through Hypertext Transfer Protocol, also known as HTTP. This tier contains all the function provided in PSMS, such as password verification, searching data and other configuration. This tier able to process user's requests and produces the result in web page format, which is in the first tier. This tier will also process any data requests of the user by linking to the database server, the bottom tier of the three-tier client/server architecture.

The bottom tier is the data repository for PSMS. The data repository is built up by the SQL database. This database stores all information needed for PSMS. The middle and bottom tier are connected through the combination of SQL and ODBC.

4.2 PSMS Module Structure

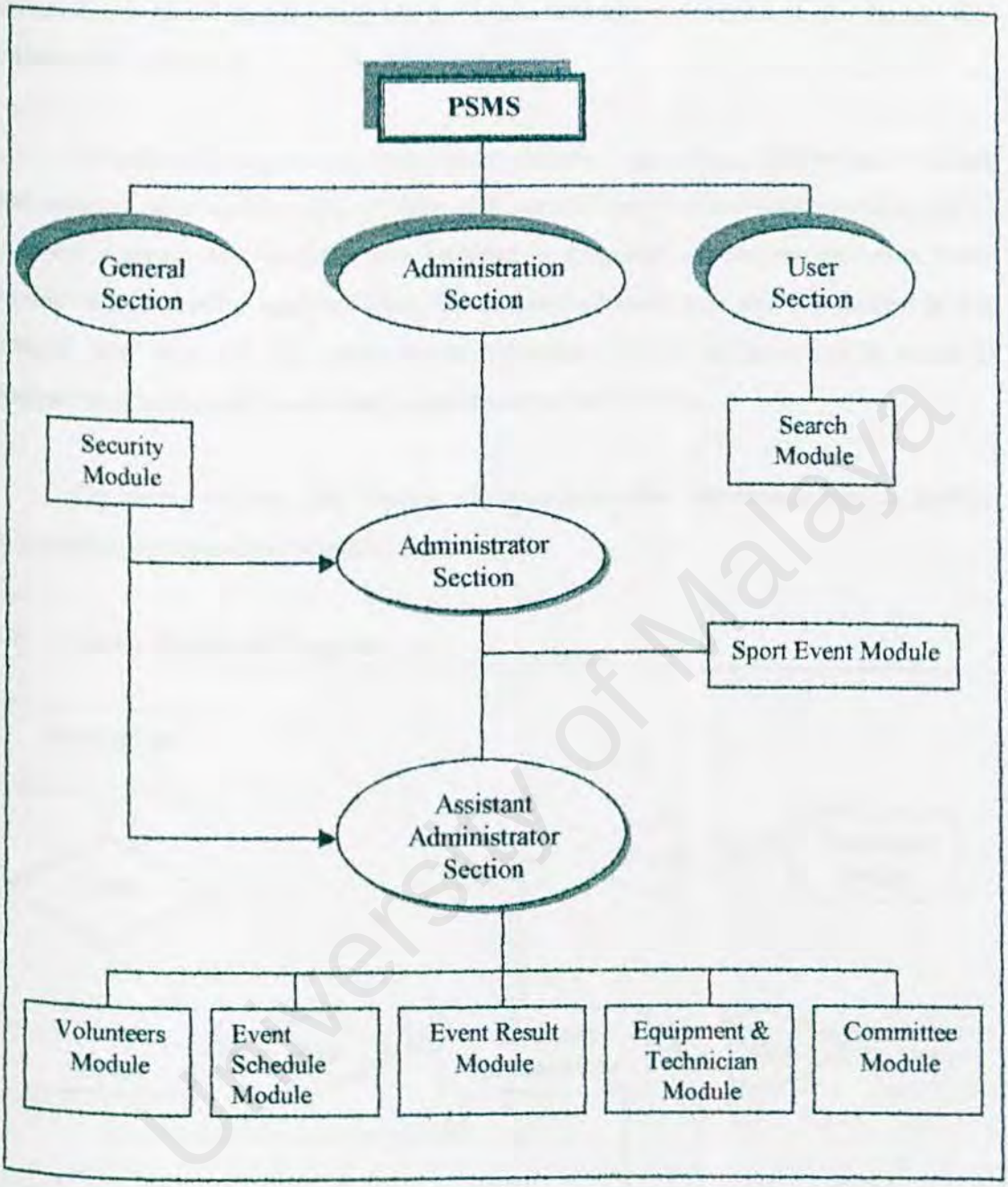

Figure 4.2: PSMS Module Structure

This Figure shows the system structure and modules that contained in PSMS. This system has been divided to three main sections: general section, administration section and user section.

The general section contains a security module. The security module prevents unauthorized administrator and assistant administrator to access and change the information in database.

The administration section was separate to two main section, administrator section and assistant administrator section. Administrator will create a new database when MPC organize a game. The modules that included in administrator section are sport event module and committee module. Then, the assistant administrator will only access to the module they handled. The modules are volunteer module, event schedule module, equipment & technician module and committee structure module.

The third section is user section, which contains only one module, search module to provide a search engine for users.

4.3 Entity-Relational Diagram

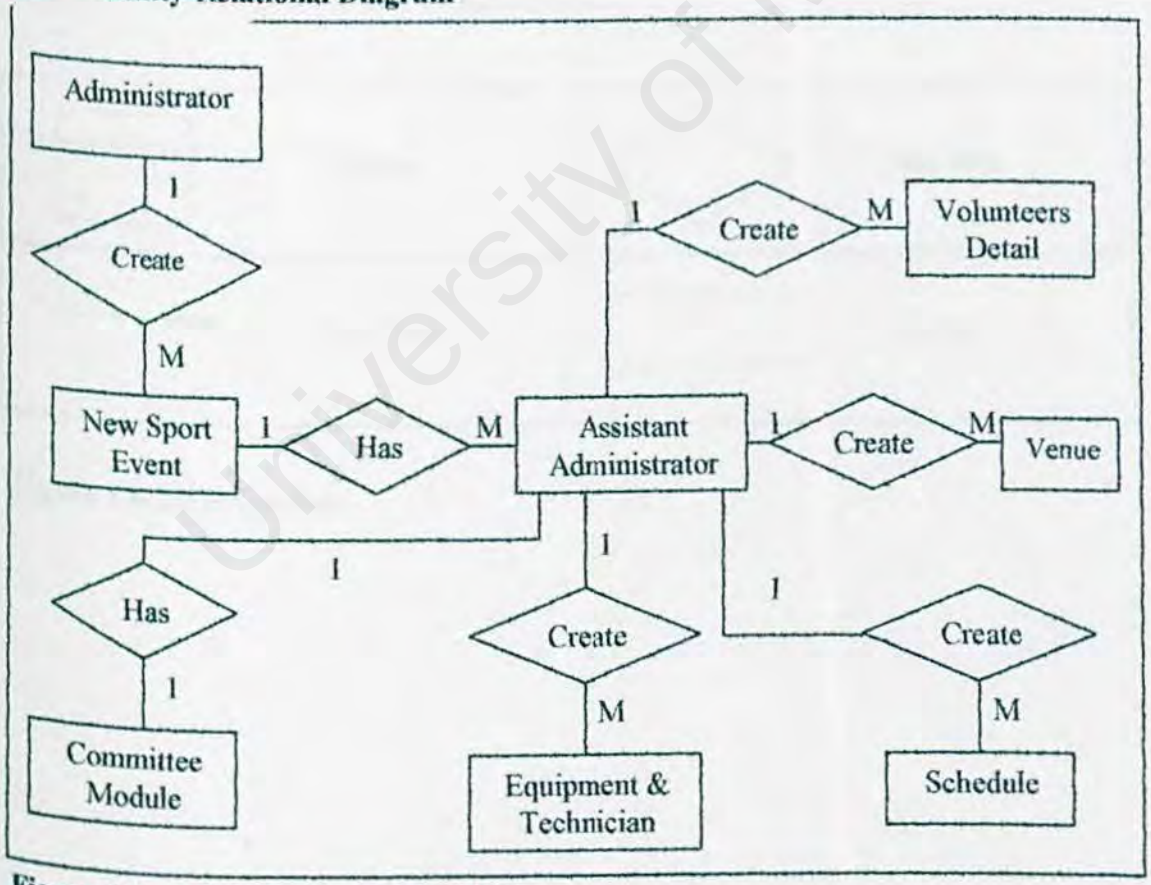

Figure 4.3: E-R Diagram for PSMS

The figure above shows the Entity-Relational Diagram. First, an administrator will create one or more than one a new sport event in database. A new sport event contains a Committee structure and many other modules that will be maintained by more than one assistant administrator. An assistant administrator will key in the information for volunteers' detail, create schedule, arrange the venue and generate technical competition reports for every game type.

4.4 Data Flow Diagram (DFD)

PSMS design is based on data flow oriented or structure design. In the data flow diagram (DFD), functional transformation process their inputs and produce outputs. As data flows from one numbered process to another, it is transformed as it moves. The symbols used in DFD are shown in figure below.

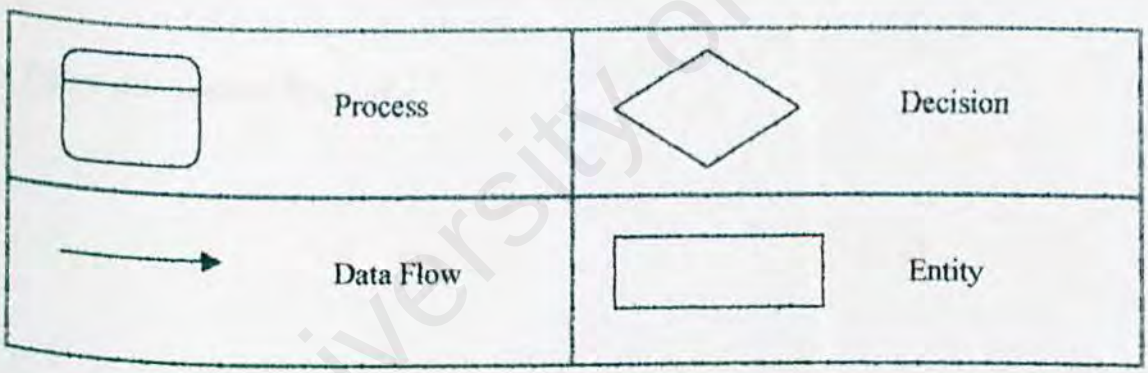

Figure 4.4: DFD Symbols

4.4.1 Context Diagram

The figure below shows the context diagram. The context diagram is the highest level in a data flow diagram and contains only one process, representing the entire system.

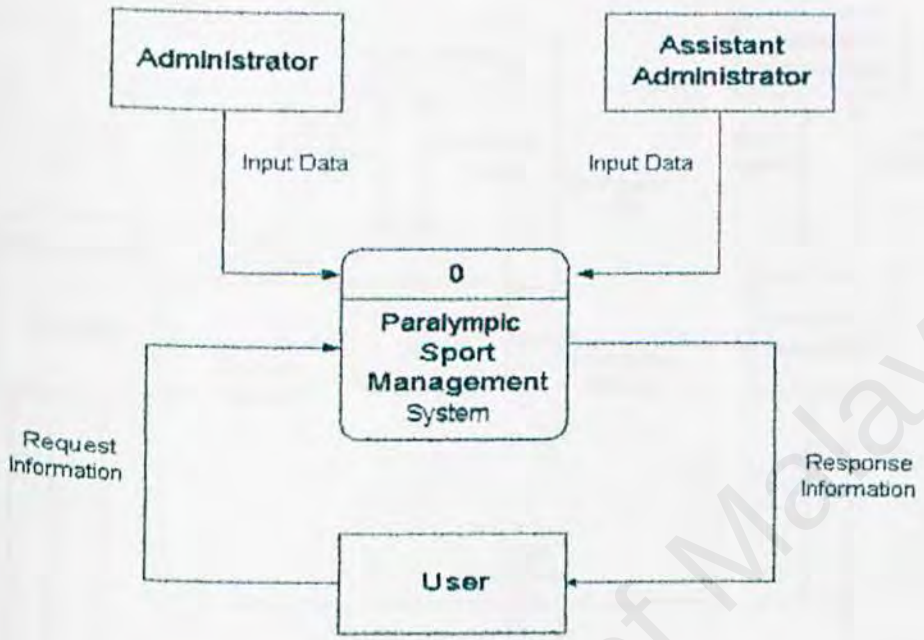

Figure 4.5: Context Diagram

4.4.2 Diagram 0

Diagram 0 (shown as below) is the explosion of the context diagram and includes three processes in PSMS.

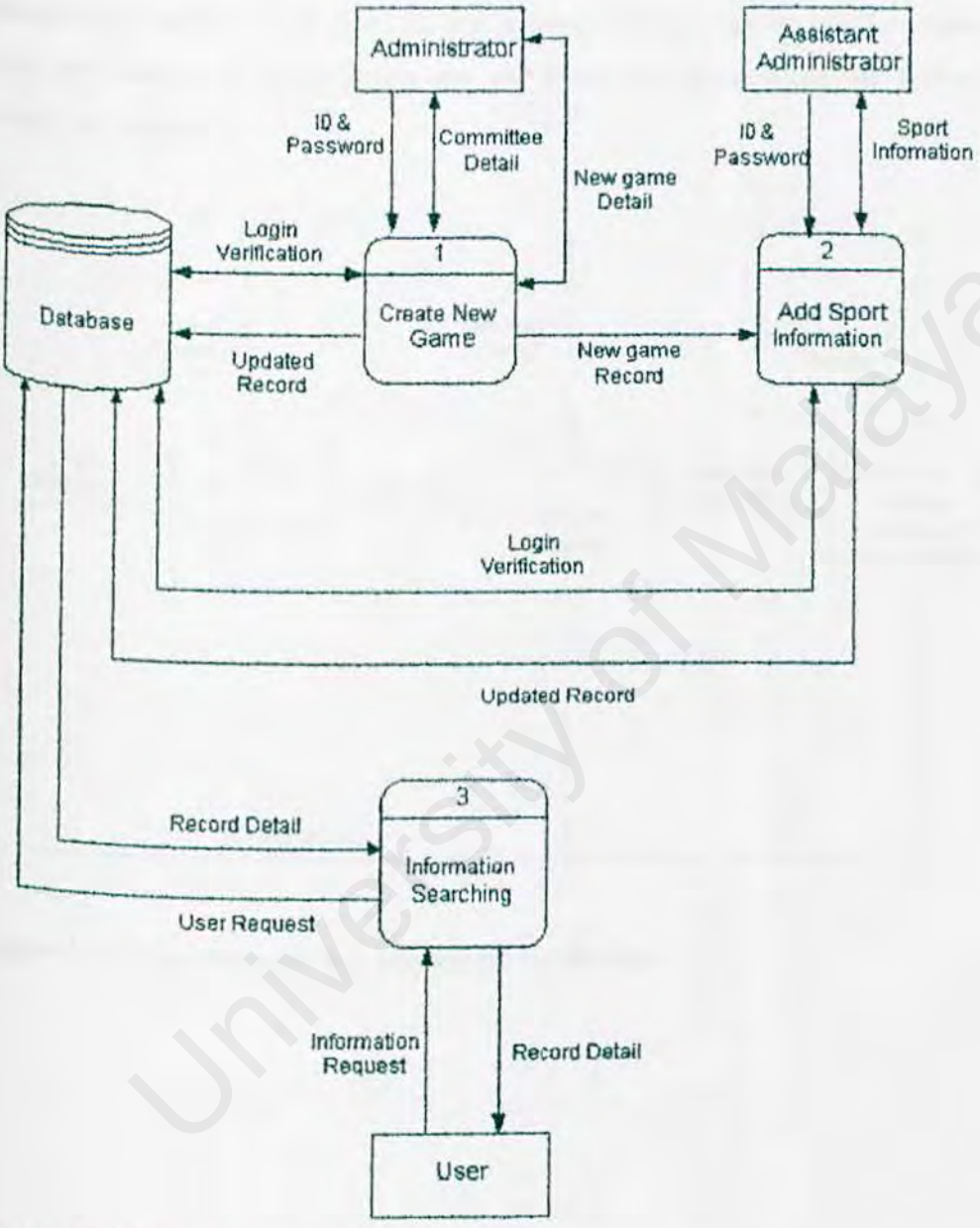

Figure 4.6: Diagram 0

4.4.3 Child Diagrams

4.4.3.1 Administrator Section

The figure below show the child diagram for administrator section. In this section, administrator need to login their ID and password before they access the system. After, login verification, the administrator can add in the new game detail and then create the committee structure.

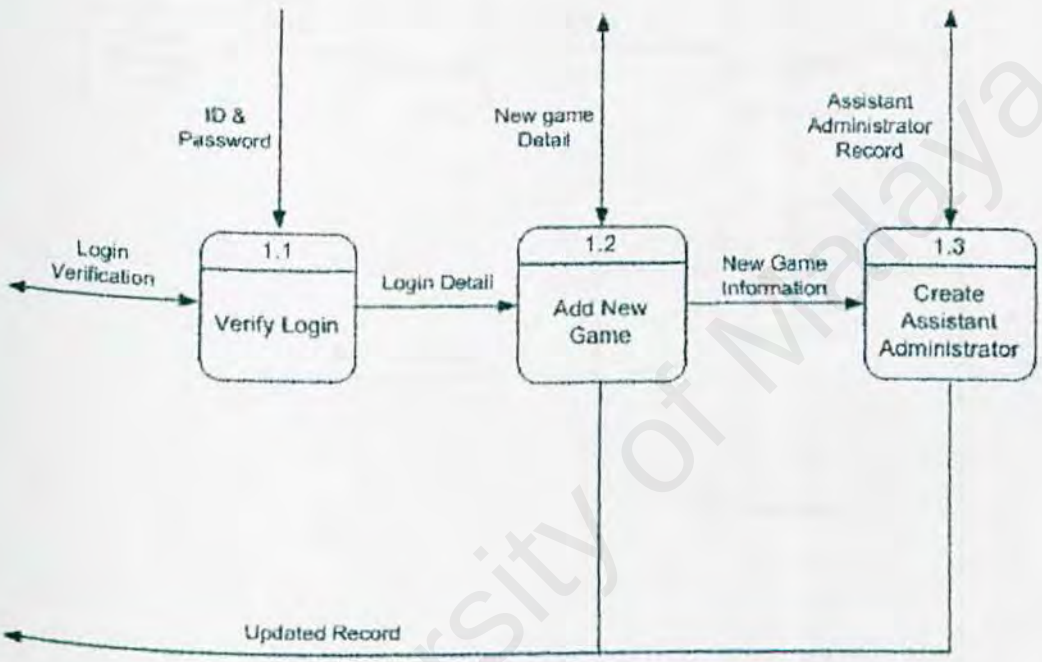

Figure 4.7: Child Diagram for Administrator Section

4.4.3.2 Assistance Administrator Section

In this section, after assistance administrator login verification process, the assistance administrator can key in the committee structure, volunteers' detail, schedule, and venue for every sport or generate a technical and competition report.

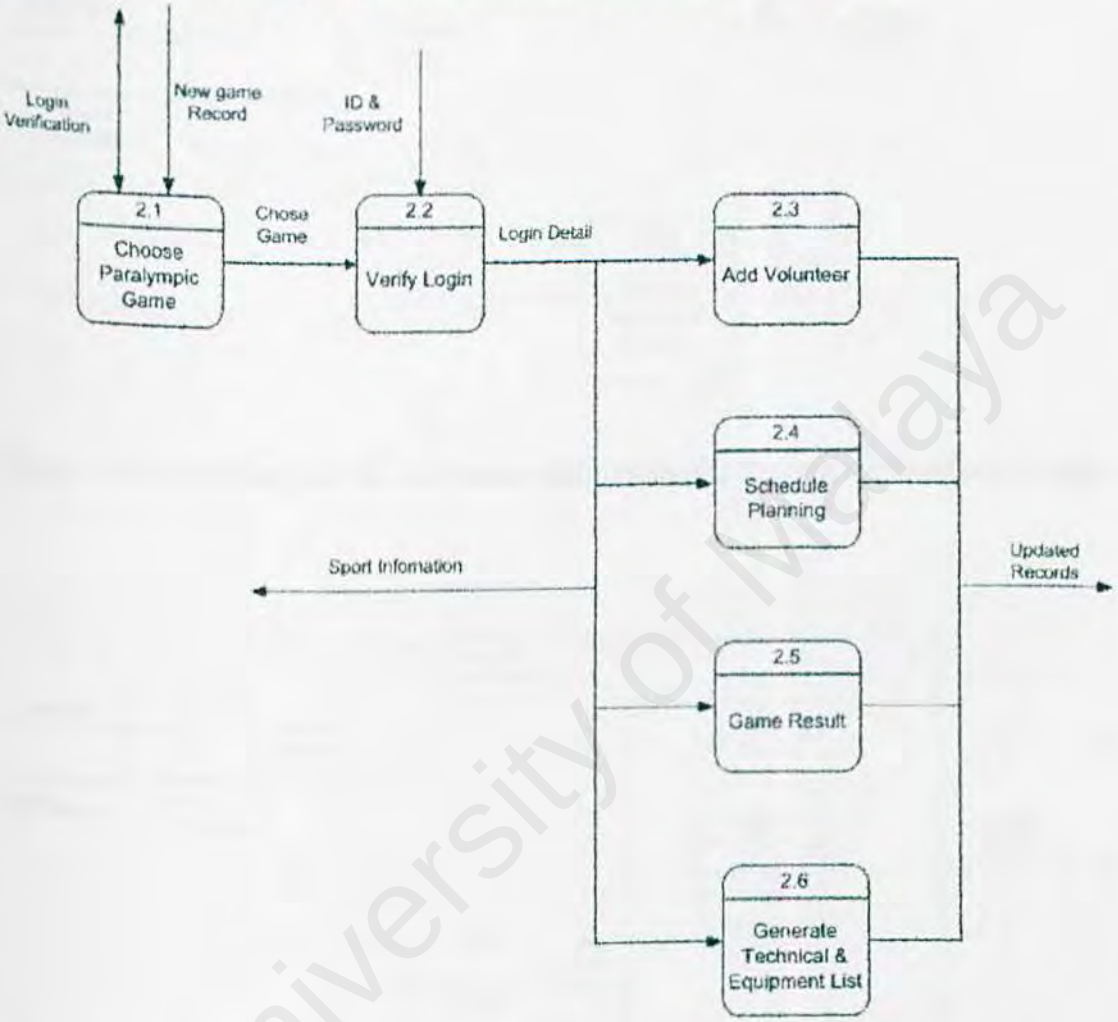

Figure 4.8: Child Diagram for Assistance Administrator Section

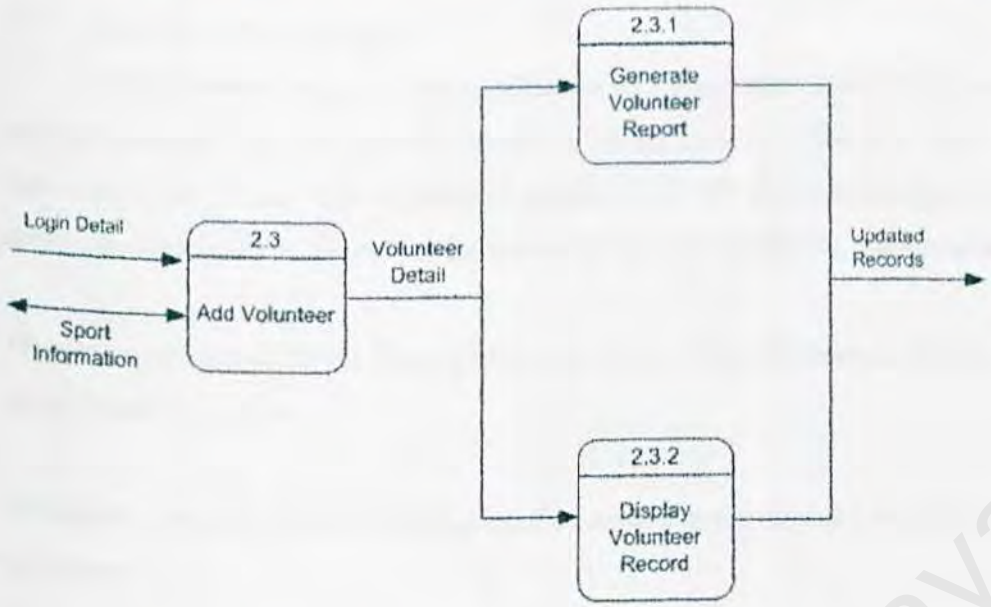

Figure 4.9: Child Diagram for Assistance Administrator Section – Volunteer Module

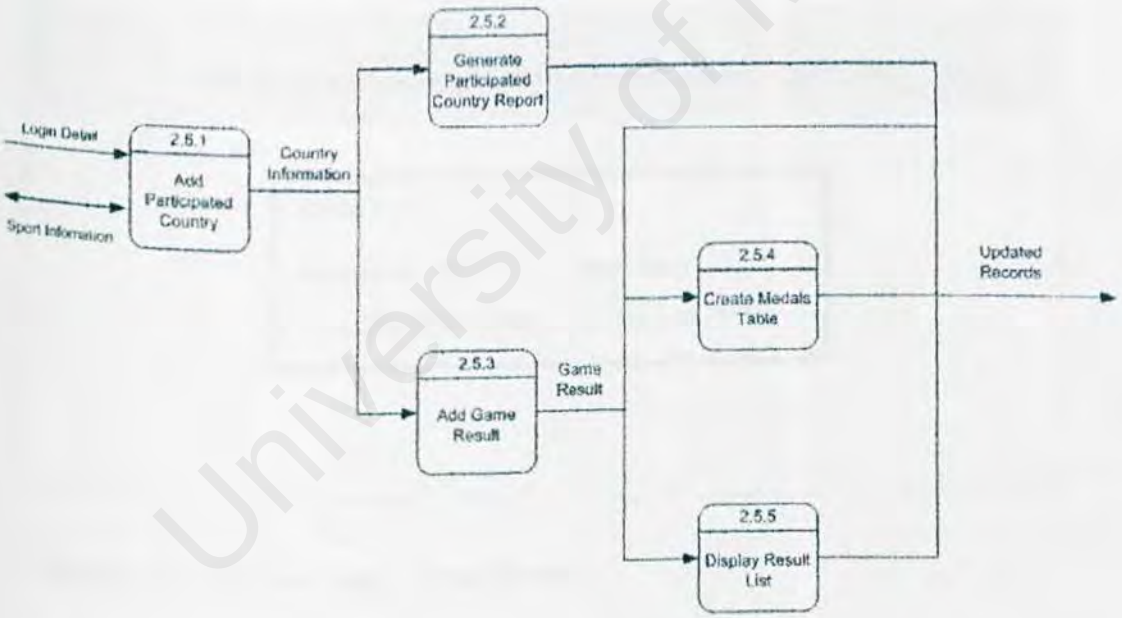

Figure 4.10: Child Diagram for Assistance Administrator Section – Result Module

4.5 User Interface design

User Interface Design is the specification of a conversion between the system user and the computer. The user interface shown in the figure below. The first figure show the main menu that contains list of games organized by MPC. The second figure shows the display or working environment for the system. It has been divided to 3 major parts:

Header area: Located in the upper part of the screen. This part contains title heading and some general navigation.

Navigation area: Located in the left part of the screen. It contains the menu navigation for the system.

Working area / display area: This part is on the right of the navigation area. It contains information display area correspond to the user menu choice.

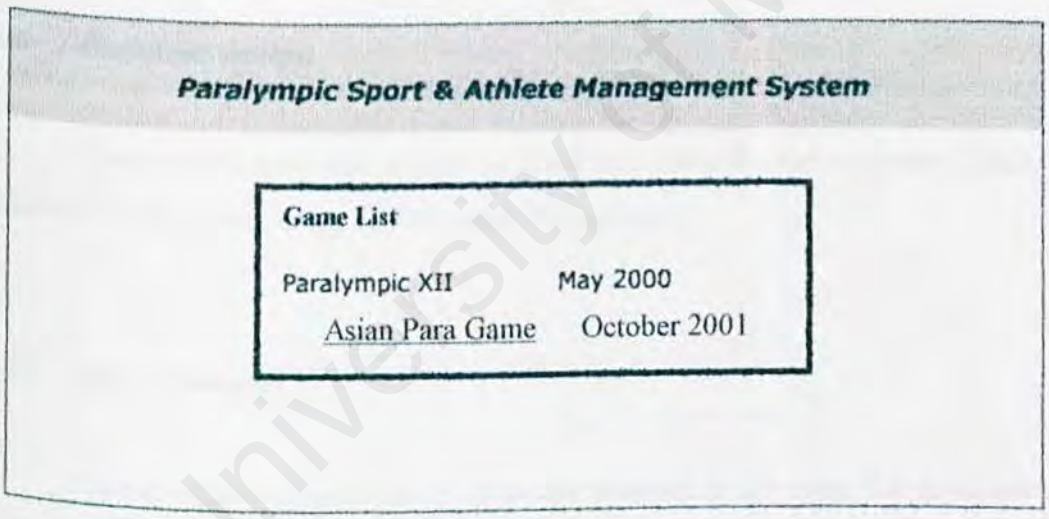

Figure 4.9: User Interface - Main Menu

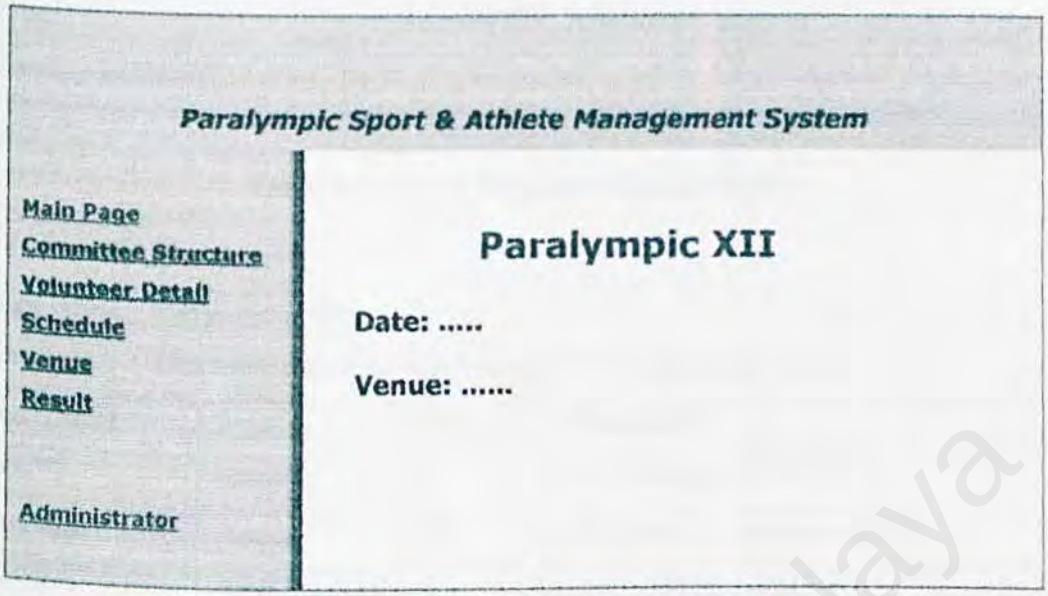

Figure 4.10: User Interface - Display/Working Environment

4.6 Database Design

Database is a collection of information or collection of a large amount of data. The database is constructed using the Microsoft SQL server 7.0.

4.6.1 Data Dictionary

Data dictionary is a repository of all the elements in a system. It is designed using the third normal form of normalization. It identifies processes where the data are used and where immediate access to information is needed.

The tables below show the data dictionary in PSMS:

File Name	paralympic.mdb
Type	Microsoft SQL Relational Database
Number of Table	7

Table 4.1: PSMS Database General Profile

Table name: dbcreatnewevent

Function: This table use to store information for a new sports event

Field Name	Type	Size	Description
eventID	numeric	9	**The Paralympic event ID**
newEvent	varchar	50	The name of new sport event
startDate	smalldatetime	4	Event opening date
endDate	smalldatetime	4	End date of the sport event
venue	varchar	50	The event's location

Table 4.2: Data Dictionary for New Paralympic Game

Table name: dbcommitteestructure

Function: This table use to store information of the committee structure

Field Name	Type	Size	Description
committeeID	numeric	9	**Committee Structure ID**
newEvent	varchar	50	The name of sport event
position	varchar	50	The name of the position in committee structure
committeeMember	varchar	100	The name of the committee member
description	varchar	200	Description or notes regarding the position in committee structure
contactNumber	varchar	15	Contact number or email address

Table 4.3: Data Dictionary for Committee Structure

Table name: dbvolunteerdetail

Function: This table use to store information of volunteers

Field Name	Type	Size	Description
volunteerID	autoint	4	Volunteer's ID
volunteerFirstName	varchar	40	Volunteer's first name
volunteerMiddleName	varchar	40	Volunteer's middle name
volunteerSurname	varchar	40	Volunteer surname
volunteerSex	varchar	1	F-female or M-male
volunteerEmail	varchar	50	Volunteer's email address
volunteerBirthDate	smalldatetime	4	Volunteer's date of birth
volunteerPhone	varchar	15	Volunteer's phone number
volunteerMobile	varchar	15	Volunteer's mobile phone number
volunteerFax	varchar	15	Volunteer's fax number
volunteerEmail	varchar	50	Volunteer's email address
volunteerAdress	varchar	50	Volunteer's address
volunteerPostcode	varchar	10	Volunteer's postcode
volunteerCity	varchar	30	City name
volunteerState	varchar	30	State name
volunteerCountry	varchar	30	Country name
newEvent	varchar	50	Show which event enter by volunteer
volunteerposition	varchar	50	Volunteer's position
description	varchar	100	Description or notes regarding the position in committee structure

Table 4.4: Data Dictionary for Volunteer Detail

Table name: dbeventschedule

Function: This table use to store information of event schedule and venue

Field Name	Type	Size	Description
newEvent	varchar	50	The name of new sport event
sportType	varchar	50	Name of the sport type
sportClassification	varchar	50	Sport classification
startTime	time	6	Start time for a sport classification
endTime	time	6	End time for a sport classification
location	varchar	50	The location for a sport classification
venue	varchar	50	The detail venue of a sport classification

Table 4.5: Data Dictionary for Event Schedule

Table name: dbcountryresult

Function: This table use to store information of the participated country in a Paralympic sport event

Field Name	Type	Size	Description
countryResultID	numeric	9	Participated country ID
country	varchar	60	Country name
newEvent	varchar	50	Paralympic Event Entered
gold	int	4	Number of gold medals have been won by the country
silver	int	4	Number of silver medals have been won by for the country
bronze	int	4	Number of bronze medals have been won by for the country

total	int	4	Total of medals have been won by the country
totalAthlete	int	4	Total of athletes participated in a game
totalStaff	int	4	Total of staff participated in a game
description	varchar	200	Notes or description about the participated country

Table 4.6: Data Dictionary for Participated Country

Table name: dbresult

Function: This table use to store information of the event result

Field Name	Type	Size	Description
resultID	numeric	9	Result ID
newEvent	varchar	50	The name of new sport event
sportType	varchar	40	Name of the sport type
sportClassification	varchar	50	Sport classification
sex	char	1	Male/ Female sport
first	char	3	First place
firstWinner	varchar	100	Name of the first winner
firstResult	varchar	20	Result for the first place
firstWinnerCountry	varchar	20	Country or state for the first winner
second	char	3	Second place
secondWinner	varchar	100	Name of the second winner
secondResult	varchar	20	Result for the second place
secondWinnerCountry	varchar	20	Country or state for the second winner
third	char	3	Third place
thirdWinner	varchar	100	Name of the third winner
thirdResult	varchar	20	Result for the third place

thirdWinnerCountry	varchar	20	Country or state for the third winner
fourth	char	3	Fourth place
fourthWinner	varchar	100	Name of the fourth winner
fourthResult	varchar	20	Result for the fourth place
fourthWinnerCountry	varchar	20	Country or state for the fourth winner
fifth	char	3	Fifth place
fifthWinner	varchar	100	Name of the fifth winner
fifthResult	varchar	20	Result for the fifth place
fifthWinnerCountry	varchar	20	Country or state for the fifth winner

Table 4.7: Data Dictionary for Result Module

Table name: dbequipment

Function: This table use to store information of event schedule and venue

Field Name	Type	Size	Description
equipmentID	numeric	9	Equipment ID
newEvent	varchar	50	The name of new sport event
sportType	varchar	40	Name of the sport type
sportClassification	varchar	50	Sport classification
sex	char	1	Male/ Female sport
equipment_1st	varchar	100	The equipment needed for a sport classification
equipment_2nd	varchar	100	The equipment needed for a sport classification
equipment_3rd	varchar	100	The equipment needed for a sport classification
equipment_4th	varchar	100	The equipment needed for a sport classification

equipment_5th	varchar	100	The equipment needed for a sport classification
incharge_1st	varchar	60	Technician or person in charge
incharge_2nd	varchar	60	Technician or person in charge
incharge_3rd	varchar	60	Technician or person in charge
incharge_4th	varchar	60	Technician or person in charge
incharge_5th	varchar	60	Technician or person in charge
contact_1st	varchar	15	Contact Number or email Address for technician
contact_2nd	varchar	15	Contact Number or email Address for technician
contact_3rd	varchar	15	Contact Number or email Address for technician
contact_4th	varchar	15	Contact Number or email Address for technician
contact_5th	varchar	15	Contact Number or email Address for technician

Table 4.8: Data Dictionary for Equipment and Technician Module

4.7 Chapter Summary

Chapter 4, System design will give a detail idea about how the system works. It contains the system architecture, module structure, E-R diagram, data flow diagram and user interface design and data dictionary. This system will use three-tier architecture, which contains three layers: application/presentation tier, functionality/service tier and finally data repository. The database contains seven tables to store all the Paralympic information.

Chapter 5: System Implementation

~ Development Environment
~ Changes In System Design
~ Project Development
~ Example Coding
~Chapter Summary

Chapter 5: System Implementation

System implementation is a process that converts the system requirements and design into program codes. This phase at time involves some modifications to the previous design.

5.1 Development Environment

Development environment has certain impact on the development of a system. Development environment consists of hardware and software configurations. Using the suitable hardware and software is an important factor to determine the successful of a project. The hardware and software tools used to develop and documented the entire system are listed below.

5.1.1 Hardware Requirements

The following hardware specifications have been used to develop this system:

- Intel Pentium III 450Mhz processor
- 128MB SD RAM
- 15 GB Hard Disk
- 14" 256-colour monitor capable of 800 x 600 resolution
- 1.44 MB Floppy Drive
- 45X CD-ROM Drive
- Speaker
- Other standard computer peripherals

5.1.2 Software Tools Requirement

Software Tools for Drawing, Design and Report Writing

The design process involves the drawing of structure chart, data flow diagram, ER diagram and other diagram or drawing. The tools used are Microsoft PowerPoint 2000, Microsoft Word 2000, Microsoft Visio 2000 and Microsoft Excel 2000.

Software Tools for Program Development

Many software tools have been used during the PSMS development process. The software that have been used for program development are:

Software	Usage	Description
Microsoft Windows 2000	System Requirement	Operating System
Internet Information Server 5.0	System Requirement	Web Server Host
Microsoft Internet Explorer 5.0 and above	System Requirements	Web browser
Microsoft Visual InterDev 6.0	System Development	Coding the Program
Microsoft SQL Server 7.0	Database	Store and Manipulate Data
Microsoft Front Page 2000	System Development	Interface Design
Adobe Photoshop 6.0	System Development	Graphics Editor
SWiSH 2.0	System Development	Animation Creator
Notepad	System Development	HTML editing

Table 5.1 Software Configurations

5.2 Changes In System Design

There are some changes have been made in system design during the system implementation. The changes are:

5.2.1 Security Module

This security module was discussed in earlier chapter. As mention earlier, this PSMS system will be integrate with another two application, PAMS and POSC to become a more complete Paralympic sport management system. PSMS and PAMS are intranet system and will be integrated as a single application. Therefore, this two system needs only one security module and this module will be done in PAMS system. The security module will be added in to PSMS during the integration process.

5.2.2 Search Module

In system design, this module was built for other user besides administrator and assistant administrator. However, this module now will be used for all users including administrator and assistant administrator. This module will be added in to committee structure module, volunteer module and participated country module. The other modules will not contain this search function because those modules will contain a different display functions as discussed below.

5.2.3 Display Function

The event schedule module, event result module and equipment & technician module will contain an addition display function. All users including the administrator and assistant administrators can use this function. For event schedule module, the record can be view according to Paralympic sport type, location and date. For the other two modules, the records can be view according to Paralympic sport type.

5.3 Project Development

The design must be translated into the form that can be understood by the machine. The development process is basically including 3 stages, which are data preparation, coding for functions and system integration.

5.3.1 Data Preparation

The system implementation is started with data preparation. This stage includes the still images drawing, designing and editing, creates animation files and form designing.

5.3.1.1 Still Images

Still images are included in the various pages within the web application. These still images are save in either Graphics Interchange Format (*.gif*) format or JPEG File Interchange Format (*.jpg*) format. All of the images are created and edited using Adobe Photoshop 6.0 and Microsoft Paint Version 5.0. These images have optimized file size for faster web delivery.

5.3.1.2 Animation File

An animation file will make the web page more attractive. Animation file is created using SWiSH 2.0. This software is able to create animated image or text. The animation file created by SWiSH 2.0 will generate an object file and will be inserted into the web application.

5.3.1.3 Interface Design, Form Design and Paralympic Sport Information

Before coding stage, the interface and form will be design first. The Paralympic sport information will help the coding process. It is a must to ensure the design of a form and data will be input is correct. In other words, the form was designed according to Paralympic sport information, for example the sport type and sport classification.

5.3.1.4 Database Connection

Creating database is an important step before the coding of web pages that involve process of data input by user. The database chosen for PSMS is SQL server 7.0. This database contains seven tables to store all the Paralympic sport information.

5.3.2 Coding

The design must be translated into the form that can be understood by the machine. The code generation step performs this task. Since this is a web-based ordering system, the scripts are coded using HTML, server side script and client side script that should support and enhance the web application.

5.3.2.1 Processes in Coding

1. Interface Design and Coding

The first step is to design and coding the interface. The images and animation file will be inserted during the interface design and coding process. This process mainly is written using HTML code.

2. Coding the Form

The second step in coding stage is to design the forms that have been designed in data preparation stage. The PSMS system contains seven forms and those forms will be use by administrator to add and update record in data store and all the entire forms are coding using HTML code. The forms are:

- ✓ New Paralympic event/game form
- ✓ New committee structure form
- ✓ New volunteer detail form
- ✓ Event schedule form
- ✓ Participated country form
- ✓ Event result form
- ✓ Equipment and technician form

2. Add Record to Data Store

After designing the form, the next step is tried to insert data into data store. The program will first make a *Recordset* object and connect to data store. After connected to data store, the program will then create a new, empty record within the *Recordset* and then add the new data to *Recordset* with the data from the form. (Please refer to *5.4.1 VBScript and SQL Statement – Display Record – Add New Record to Data Store*). Mainly, this process is built according to number of forms in PSMS. Therefore, PSMS contains seven files for adding data to data store.

3. Display Data from Data Store

The following codes are written to display the record in a list. These codes will make connection to data store; get the record using SQL statement and display the data. Some of the pages are able to display records according to sport type, date and location. This process involves some JavaScript programming. Besides, the data also can be viewed in form format, which is same with the form listed as above. (Please refer to *5.4.1 VBScript and SQL Statement – Display Record*).

4. Update and Delete Data

The purpose of this process is to update and delete record from data store. It is written in VBScript and SQL statements (Please refer to *5.4.1 VBScript and SQL Statement – Update record / Delete record*).

5. Validate Input Data

Input data validation is written for every form to ensure administrator key in the correct data. It will check the length for data input, make sure the administrator key in the important data, check valid number and check valid date. All codes are written in JavaScript. If administrator key in the incorrect data, an alert error message windows will pop up and give instruction to administrator to key in the correct data. (Please refer to *5.4.2 JavaScript – Validate Data*).

6. **Generate Report**

This process will generate a report using the data in data store. The program is written in VBScript and SQL statement. It will show the information in chart or in table form. The generated reports are:

- ✓ Volunteer Report:

  This report contains two bar charts. The first bar chart is generated according to volunteer's sex, and the second bar chart is generated according to the volunteer's position or responsible field.

- ✓ Participated Countries Report

  This report contains two bar charts; the first chart show the number of participated athletes from different country and the second chart show the number of staff send by different country.

- ✓ Medals Table:

  This report shows the medals table according to the participated country and calculates the total medals won by the participated country.

7. **Coding for Record Searching**

Coding for record searching is written in VBScript and SQL statements. Users are allow searching data or record using key words or match the exact phrase (Please refer to *5.4.1 VBScript and SQL Statement – Search Record*). The modules that contains search function are:

- ✓ Committee Structure Module

  Users are allowed to search record using key words or exact phrase for committee members name, position, contact number or priority field.

- ✓ Volunteer Module

  Users are allowed to search record for volunteer ID, first name, middle name, surname or position.

- ✓ Participated Country Sub Module

  Users are allowed to search data for country name.

8. Create Navigation menu

The following step is to create the navigation menu where is located on the left hand side of the PSAMS web pages. This navigation menu is written using JavaScript and DHTML. It contains the links to other pages and some mouse over effect. (Please refer to *5.4.2 JavaScript – Navigation Menu/Left Menu*).

5.3.2.2 Coding Principles

Several principles are applied during the development of this system to ensure that the quality and the proper structure in the code generation.

I. Readability

Codes should be easy to read and understandable. It is very important when it comes to the enhancement of the system in the future by other people. In addition, the meaningful variable names and statement labels will also be helpful in reading and understanding the code.

II. Maintainability

Codes should be easy to read, corrected and revised. Codes that perform functions for a module should be grouped together. Besides this, the codes should be tried as simple as possible with doing in separate module. It is called loose coupling.

III. Robustness

Robustness refers to the quality that causes a system to be able to handle unexpected error and echo back with proper responses. Errors handling should be done to increase the robustness of the system. Appropriate errors message should be displayed response to user's input. System failure should be minimized or avoid it to be happened.

5.3.3 System Integration

The last stage in system implementation is system integration. As mention earlier, this PSMS system will be integrated with other two systems: PAMS and POSC. Some changes either in coding or design will be made during the integration process. Although these three applications are using the same template design; however there are still have some changes in system design. The changes that have been made are:

- ✓ Font size and font color
- ✓ Table background color
- ✓ Record displayed format
- ✓ Background color
- ✓ Add in some images

Besides, the system integration also did some changes in coding or function. This contains:

- ✓ Add in the security module
- ✓ Add in the related links

5.4 Example Coding

The examples coding will give an overall description on how the system has been developed. The development process

5.4.1 VBScript and SQL Statement:

Link to data using Recordsets and connections:

```
set objConn=server.CreateObject ("ADODB.connection")
objConn.Open "Provider=SQLOLEDB.1;UID=sa;Initial Catalog=paralympic"
```

The code above shows how to get data from the data store into a Recordset object with connection to database. The first line will create a Recordset object; while the second line will forge a connection between the application code and the data store with *open* method.

Add new record to database:

```
<%
 Dim rsUsers, action, events, strName, strValue
 action = Request.Form ("action")
 events = Request.Form ("newEvent")
 Set rsUsers = Server.CreateObject("ADODB.Recordset")
 rsUsers.Open "dbcommitteestructure", objConn, adOpenForwardOnly, adLockOptimistic,
adCmdTable
 If action = "add" Then
  If Request("committeeID") = "" Then
                rsUsers.AddNew          ' ...so add a new record
                rsUsers("newEvent") = Request.Form("newEvent")
                rsUsers("priority") = Request.Form("priority")
                rsUsers("position") = Request.Form("position")
                rsUsers("committeeMember") = Request.Form("member")
                rsUsers("contactNumber") = Request.Form("contact")
                rsUsers("description") = Request.Form("description")
                rsUsers.Update                                  ' update the database
      End If
 End If
%>
```

The codes above show how to add a new committee structure record to database. The database name is dbcommitteestructure. First, this code will make a Recordset object and make connection to data store. Then, it will add a new record using *rsUsers.AddNew* and finally update the record with the data received from the form in previous page.

Update Record:

```
If action = "update" Then
        rsUsers.Filter = "committeeID = '" & Request("committeeID") & "'"
        rsUsers("newEvent") = Request.Form("newEvent")
        rsUsers("priority") = Request.Form("priority")
        rsUsers("position") = Request.Form("position")
        rsUsers("committeeMember") = Request.Form("member")
        rsUsers("contactNumber") = Request.Form("contact")
        rsUsers("description") = Request.Form("description")
        rsUsers.Update
End If
```

This code is able to update the record with data received from the form in previous page. After create a Recordset object and make connection to data store, it will update the record using *rsUsers.Update*. Before it update the record, it needs to filtering the records from data store. Filtering records will find a record involve searching the recordset until it find one record that matches what we are looking for.

There is another approach to update the record:

```
Dim newEvent
newEvent = Request.Form ("newEvent")
Dim ssql
ssql="Update dbcommitteestructure set newEvent='" & newEvent & "' where newEvent='" &
        Request.Form ("oldEvent") & "'"
objconn.execute ssql
```

This code updates the record using SQL statement. The fourth line shows the SQL statement and the last line will execute the SQL statement and update the record in data store.

Delete record:

```
rsUsers.Filter = "committeeID = '" & Request("committeeID") & "'"
If Not rsUsers.EOF Then rsUsers.Delete
```

After filtering the records from data store, this code is able to delete a record using *rsUsers.Delete* command.

Another approach to delete a record is to use SQL statement. The code will be shown as below:

```
ssql="Delete dbcommitteestructure where newEvent='" & newEvent & "'"
objconn.execute ssql
```

The first Line shows the SQL statement and the second line will execute the SQL statement and delete the record from data store.

Display Record:

```
dim count, eventselected, total
total = 0
eventselected = Request.QueryString ("event")
Session("newEvent") = eventselected
set objConn=server.CreateObject ("ADODB.connection")
objConn.Open "Provider=SQLOLEDB.1;UID=sa;Initial Catalog=paralympic"
set rs=server.CreateObject ("ADODB.recordset")
rs.Open "select * from dbcommitteestructure order by priority, position",objConn
If not rs.EOF then
    Response.Write "<table border=""1"" bordercolor=""#D8D7D9"" width=""85%"">"
    Response.Write "<tr>"
    Response.Write "<th width=""33%"" bgcolor=""#52527A""><font color=""#FFFFFF""
face=""verdana"" size=""2""><b>Position</b></th>" & "<th width=""37%""
bgcolor=""#52527A""><font color=""#FFFFFF"" size=""2"" face=""verdana""><b>Committee
Member</b></th><th width=""30%"" bgcolor=""#52527A""><font color=""#FFFFFF"" size=""2""
face=""verdana""><b>Contact Number</th></tr>"

    Do While Not rs.EOF
        If Session ("newEvent") = rs("newEvent") Then
                Response.Write "<tr><td> <font size=""2""><a
href=""selectedCommittee.asp?committeeID=" & rs("committeeID") & "&event=" &
eventselected & " "">" & rs("position") & "</td>"
                Response.Write "<td> <font face=""Tahoma"" size=""2""
color=""#3C4248"">" & rs("committeeMember") & "</td><td><font face=""Tahoma"" size=""2""
color=""#3C4248""> " & rs("contactNumber") & "</td></tr>"
                count = TRUE
                total = total + 1
        End If
        rs.MoveNext
    Loop
End If
rs.Close
objConn.Close
```

The code above will display all the record from data store. The statement: "*select * from dbcommitteestructure order by priority, position*" is a SQL statement, it will get all the data from *dbcommitteestructure* table and arrange the record according to priority field follow by the position field.

Search Record:

```
<%
  searchquery = Request.Form("SearchQuery")
  searchword = Split(searchquery)
  searchfield = Request.Form("SearchField")
  searchmatch = Request.Form("SearchMatch")

  If searchquery <> "" Then

    Dim rsSearch, strSQL
        strSQL = "SELECT * FROM dbcountryresult where newEvent='" & Request("newEvent")
& "'" & " AND "
    Select Case searchmatch
        'any words
        Case "AnyWords"

        ' search according to search type
        If searchfield="country" Then
          strSQL = strSQL & "("
          strSQL = strSQL & " ( country LIKE '%" & searchword(0) & "%'"
          For s = LBound(searchword) + 1 to UBound(searchword)
           If searchword(s) <> "" and UCase(searchword(s)) <>"OR" and searchword(s) <> "-"
and UCase(searchword(s)) <> "AND" and searchword(s) <> "+" and UCase(searchword(s)) <>
"NOT" and searchword (s) <> "<>" Then

                If UCase(searchword(s-1)) = "NOT" or searchword(s-1) = "<>" Then
                  strSQL = strSQL & " AND NOT country LIKE '%" & searchword(s) & "%'"
                Else
                If UCase(searchword(s-1)) = "AND" or searchword(s-1)="+" Then
                        strSQL = strSQL & " AND country LIKE '%" & searchword(s) & "%'"
                Else
                        strSQL = strSQL & " OR country LIKE '%" & searchword(s) & "%'"
                End If

           End If
        End IF

        Next
        strSQL = strSQL & "))"
End IF
```

```
Case "AllWords"
      If searchfield="country" Then
        strSQL = strSQL & "("
        strSQL = strSQL & " ( country LIKE '%" & searchword(0) & "%'"
        For s = LBound(searchword) + 1 to UBound(searchword)
          If searchword(s) <> "" and UCase(searchword(s)) <>"OR" and searchword(s) <> "-"
and UCase(searchword(s)) <> "AND" and searchword(s) <> "+" and UCase(searchword(s)) <>
"NOT" and searchword(s) <> "<>" Then
            If UCase(searchword(s-1)) = "NOT" or searchword(s-1) = "<>" Then
                strSQL = strSQL & " AND NOT country LIKE '%" & searchword(s) & "%'"
            Else
                If UCase(searchword(s-1)) = "AND" or  searchword(s-1) = "+" Then
                  strSQL = strSQL & " OR country LIKE '%" & searchword(s) & "%'"
            Else
                  strSQL = strSQL & " AND country LIKE '%" & searchword(s) & "%'"
            End If
          End If
        End IF
        Next
        strSQL = strSQL & "))"
      End IF

Case "ExactPhrase"
      If searchfield="country" Then strSQL = strSQL & "( country LIKE '%" &
Replace(searchquery, "'", "''") & "%')"
      If searchfield="member"  Then strSQL = strSQL & "( committeeMember LIKE '%" &
Replace(searchquery, "'", "''") & "%')"
      If searchfield="contact"  Then strSQL = strSQL & "( contactNumber='" &
Replace(searchquery, "'", "''") & "')"
      If searchfield="priority"  Then strSQL = strSQL & "( priority='" & Replace(searchquery, "'",
"''") & "')"

End Select

strSQL= strSQL & " order by country"


set objConn=server.CreateObject ("ADODB.connection")
objConn.Open "Provider=SQLOLEDB.1;UID=sa;Initial Catalog=paralympic"
Set rsSearch = Server.CreateObject ("ADODB.RecordSet")
rsSearch.Open strSQL,objConn,3,1,1
```

The code above shows how to search a record from data store. This code will search a record in *dbcountryresult* table using SQL statement. This code will let user choose either they want to search the key words or the exact words, then, the program will match the phrase key in by user with the record in database using SQL statement.

Create Cookies with Session Object:

```
set objConn=server.CreateObject ("ADODB.connection")
objConn.Open "Provider=SQLOLEDB.1;UID=sa;Initial Catalog=paralympic"
set rs=server.CreateObject ("ADODB.recordset")
rs.Open "select * from dbvolunteerdetail",objConn

If not rs.EOF then
    Do While Not rs.EOF
        If Session ("newEvent") = rs("newEvent") And Session ("volunteerID") =
rs("volunteerID") Then
            For each strField in rs.Fields
                strName = strField.Name
                strValue = strField.value
                Session(strName) = strValue
            Next
        End If
    rs.MoveNext
    Loop
End If
```

The code above will set cookies using Session object. To clear the Session, the program needs to run the code below:

```
Session.abandon
```

The code above will clear the Session.

5.4.1 JavaScript:

Validate Input Data:

1. Number:

```
<script language="JavaScript">
function validateForm(theForm) {
        validatePriority = validateNum(document.form1.priority.value, "Priority", 101)
        if (validatePriority == false)
                return false;
}

function validateNum(elems, fieldLabel, maxL){
        elems = !isNaN(elems) && (elems > 0) && (elems < maxL);
        if (!elems){
                alert('Invalid Number! \nPlease fill in a number for the '"+ fieldLabel +"' field!');
                return false;
        }
}
</script>
```

The code above was written in JavaScript. It will control the input from administrator and avoid invalid data key in by administrator. The function *validateNum()* will only received number from 0 to 100 and will pop up a message box if the administrator key in the invalid data.

2. Check length:

```
if ((document.form1.firstName.value == "") || (document.form1.firstName.value.length > 40))
        {
                alert ("Invalid data for \"First Name\" field!");
                return false;
        }
```

This code will control the length of the input data. When administrator key in more then 40 characters, it will pop up an error message box.

3. Date:

```
<script language="JavaScript">
function validateForm(theForm) {
        validateStartDate = validateDate(document.form1.startDate.value, "Start Date");
        if (validateStartDate == false)
                return validateStartDate
}

function validateDate(elemsStart, fieldLabel){
        var resultStart = true;
        if (elemsStart == "") {
                resultStart = false;
        }
        else {
                elemsStart = elemsStart.split("/");
                resultStart = (elemsStart.length == 3);
                        if (resultStart)  {
                                var month = parseInt(elemsStart[0]);
                                var day = parseInt(elemsStart[1]);
                                var year = parseInt(elemsStart[2]);
                                resultStart = !isNaN(month) && (month > 0) && (month < 13)
&& !isNaN(day) && (day > 0) && (day < 32) && !isNaN(year) && (elemsStart[2].length == 4);

                        if((month == 4) || (month == 6) || (month == 9) || (month == 11)){
                                if ((day <= 0) || (day > 30))
                                        resultStart = false;
                        }

                        if ((month == 2) && (year % 4 == 0)){
                                if ((day < 0) || (day > 29))
                                        resultStart = false;
                        }
                        else{
                                if ((month == 2) && (year % 4 != 0))
                                if ((day < 0) || (day > 28))
                                        resultStart = false;
                        }
                }
        }
  if (!resultStart) {
        alert('Invalid Date! \nPlease enter a date in the format mm/dd/yyyy \nfor the '"+ fieldLabel
+ "' field!');
  }

return resultStart;
}
</script>
```

The code shows how to control the date key in by administrator. The *validateDate()* function will only receive date in format "mm/dd/yyyy". It will pop up a message box if the administrator enters an invalid date.

4. Telephone Number:

```
if (document.form1.phone.value != ""){
                contact = document.form1.phone.value
                validContact = contact.split("-");
                var code1 = validContact[0];
                var code2 = validContact[1];
                validContact = !isNaN(code1) && !isNaN(code2)
                if ((!validContact) || (document.form1.phone.value.length > 15 )){
                        alert ("Please fill in the correct \"Telephone Number\".");
                        return false;
                }
        }
```

This code will split the phone number into two phrase between the "-" and then make sure those phrase are number. It will pop up a error message box if administrator key in the wrong input.

Navigation menu/ Left Menu:

```
<DIV id=IR03 onclick=navClick(IR3,IRp3)>
        <SPAN class=LeftNavOff id=IRp3 buttonType="LeftNav">
        Sport Management</SPAN>

        <DIV id=IR3 style="DISPLAY:
        <%if link=3 then
                Response.Write "block"
                else
                Response.Write "none"
                end if %>" onclick="window.event.cancelBubble = true;">
        <A href="committeeStructureList.asp?event=<%=Request("event")%>">
        <SPAN class=LeftNavSubOff id=cgi buttonType="LeftNavSub">Committee Structure
        </SPAN></A><BR>
        <A href="volunteerList.asp?event=<%=Request("event")%>" buttonType="LeftNavSub">
        <SPAN class=LeftNavSubOff buttonType="LeftNavSub">Volunteer Detail
        </SPAN></A><BR>
        <A href="eventSchedule.asp?event=<%=Request("event")%>"
buttonType="LeftNavSub">
        <SPAN class=LeftNavSubOff buttonType="LeftNavSub">Event Schedule
        </SPAN></A><BR>
        <A href="resultList.asp?event=<%=Request("event")%>" buttonType="LeftNavSub">
        <SPAN class=LeftNavSubOff buttonType="LeftNavSub">Game Result
        </SPAN></A><BR>
        <A href="equipmentList.asp?event=<%=Request("event")%>"
buttonType="LeftNavSub">
        <SPAN class=LeftNavSubOff buttonType="LeftNavSub">List of Equipment
        </SPAN></A><BR>
```

The code above shows the navigation bar where is located on the left hand side in the PASMS web page. When users click on the button, it will pull down a sub menu and users can choose the link he or she want to go. This code is written in JavaScript and it also involves *css* file to build up the mouse over effect.

The example of *css* file will be shown as below:

```
.LeftNavOff
{
   BACKGROUND-COLOR: #42568a;
   BORDER-BOTTOM: #42568a 1px solid;
   BORDER-LEFT: #42568a 1px solid;
   BORDER-RIGHT: #42568a 1px solid;
   BORDER-TOP: #42568a 1px solid;
   COLOR: #ffffff;
   CURSOR: hand;
   FONT-FAMILY: verdana;
   FONT-SIZE: 11px;
   FONT-WEIGHT: bold;
   LETTER-SPACING: -0.5pt;
   LINE-HEIGHT: 20px;
   MARGIN: 2px 0px;
   PADDING-BOTTOM: 0px;
   PADDING-LEFT: 10px;
   PADDING-RIGHT: 3px;
   PADDING-TOP: 0px;
   TEXT-DECORATION: none;
   WIDTH: 140px
}
.LeftNavUp
{
   BACKGROUND-COLOR: #345f93;
   BORDER-BOTTOM: #333366 1px solid;
   BORDER-LEFT: #5689bc 1px solid;
   BORDER-RIGHT: #333366 1px solid;
   BORDER-TOP: #5689bc 1px solid;
   COLOR: #ffffff;
   CURSOR: hand;
   FONT-FAMILY: verdana;
   FONT-SIZE: 11px;
   FONT-WEIGHT: bold;
   HEIGHT: 0pt;
   LETTER-SPACING: -0.5pt;
   LINE-HEIGHT: 20px;
   MARGIN: 2px 0px;
   PADDING-BOTTOM: 0px;
   PADDING-LEFT: 10px;
   PADDING-RIGHT: 3px;
   PADDING-TOP: 0px;
   TEXT-DECORATION: none;
   WIDTH: 140px
}
```

The code above shows part of the DHTML codes. It will give the effect when users click on or mouse over the button in left menu.

Mouse Over Effect for Image:

```
nereidFadeObjects = new Object();
nereidFadeTimers = new Object();

function nereidFade(object, destOp, rate, delta){
if (!document.all)
return
   if (object != "[object]"){  //do this so I can take a string too
      setTimeout("nereidFade("+object+","+destOp+","+rate+","+delta+")",0);
      return;
   }

   clearTimeout(nereidFadeTimers[object.sourceIndex]);

   diff = destOp-object.filters.alpha.opacity;
   direction = 1;
   if (object.filters.alpha.opacity > destOp){
      direction = -1;
   }
   delta=Math.min(direction*diff,delta);
   object.filters.alpha.opacity+=direction*delta;

   if (object.filters.alpha.opacity != destOp){
      nereidFadeObjects[object.sourceIndex]=object;

nereidFadeTimers[object.sourceIndex]=setTimeout("nereidFade(nereidFadeObjects["+object.so
urceIndex+"],"+destOp+","+rate+","+delta+")",rate);
   }
}
```

The code will give an effect to an image when user mouse over the image. The image first will set to transparent, when users mouse over the image, the image will be displayed.

5.3.3SWiSH 2.0 Generated Code

SWiSH 2.0 is a software used to create animation file. It will generate an object code as below:

```
<object classid="clsid:D27CDB6E-AE6D-11cf-96B8-444553540000"
 codebase="http://active.macromedia.com/flash2/cabs/swflash.cab#version=4,0,0,0"
 id="athlete" width="83" height="122">
 <param name="movie" value="images/athlete.swf">
 <param name="quality" value="high">
 <param name="bgcolor" value="#D4D4D4">
 <embed name="athlete" src="images/athlete.swf" quality="high" bgcolor="#D4D4D4"
  width="83" height="122"
  type="application/x-shockwave-flash"

pluginspage="http://www.macromedia.com/shockwave/download/index.cgi?P1_Prod_Version=
ShockwaveFlash">
 </embed>
</object>
```

This code shows the object file for the animated file and the paths of the animation file.

5.5 Chapter Summary

This chapter discusses the development environment, changes in system design and project development. In project development the stages or processes in developing PSMS will be discussed. This chapter also shows the example coding in PSMS to give an overview how the coding was developed.

Chapter 6: System Testing

- ~ *Testing Techniques*
- ~ *Unit Testing*
- ~ *Integration Testing*
- ~ *Overall System Testing*
- ~ *Acceptance Testing*
- ~ *Test Case Report1*
- ~ *Chapter Summary*

Chapter 6: System Testing

System testing is a critical phase that ensures the system fulfills user requirements. Testing is performed to detect the existence of faults and then try to correct it. Therefore, a systematically test procedure is need to make sure the system is tested thoroughly and completely.

6.1 Testing Techniques

Testing is a process used in system development to avoid bug in the system. Thus, testing is a process of executing a program with the intent of finding bug or error and identifying defects and bugs for subsequent correction and elimination. There are two approaches were used in system testing, namely, White Box testing and Black Box testing.

White Box Testing

White Box testing is a test case design method that uses the control structure of the procedural design to derive test case as shown in Figure 6.1. It treats a product as a 'White Box' that is with transparent walls. Such testing allows detailed examination of the codes in order to create tests that will force execution of all possible branch alternatives. It ensures that all possible paths through and actions have been exercised whilst the system is under testing. In developing PSMS, White Box testing was implement in module testing.

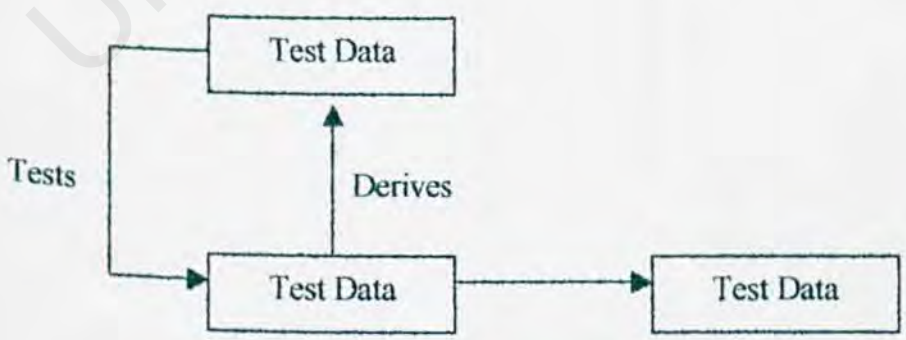

Figure 6.1: White Box testing

Black Box Testing

Black Box testing is focus on the functional requirements of the system as shown in Figure 6.2 below. It treats a product as a 'Black Box', that is an entity, which the tester cannot see. This testing technique is not an alternative to White Box testing; rather it is a complementary approach that is likely to uncover a different class of errors. This level of testing is usually performed at the system level. It is used to find incorrect or malfunctions, interfaces errors, performance errors and initialization and termination errors.

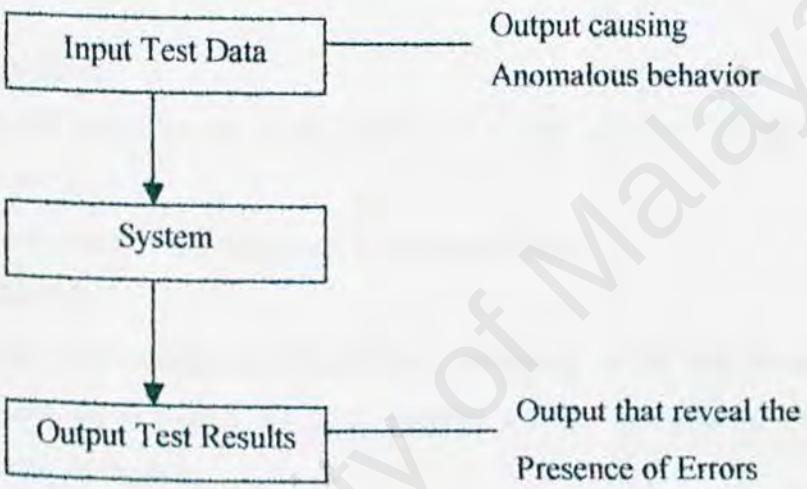

Figure 6.2: Black Box Testing

6.2 Unit Testing

Unit testing concentrates on the smallest unit of software design. It is refers to the functions and modules in system. The unit testing was conducted throughout the implementation once a new unit was successfully built up. All units are tested independently to ensure that it operates correctly and free from errors.

In PSMS, every function is tested separately. It is to ensure that every function in the module is performed as desire. The tested units in PSMS basically are:

- ✓ Form submission

  This will check whether the form is submitted to the data store and have been saved.
- ✓ Display format

  To ensure all records are displayed in selected format.
- ✓ Input validation

  To test the input validation formula goes according to the criteria specified when administrator fill in a form. An error message window will pop up for the incorrect input validation formula.
- ✓ Search Module

  To ensure the search module is function properly and able to search record using key words or exact phrase.
- ✓ Report generating

  Check the generating report is function properly and the statistic is correct.

6.3 Integration Testing

After satisfied that the individual components are working correctly and meet the system objectives, the components will be combined into a working system. In this stage of testing, each module contains functions and procedures is checked and tested carefully. These sub-functions may call other sub-functions and tests are carried out to ensure all possible paths are tested. Besides, all links in the web pages are tested. It is to ensure that every one of the hyperlink can lead to an existing and correct destination page.

For PSMS, the approach that has been used to merging components to test is bottom-up testing. This means each component at the lowest level of the system hierarchy is tested individually. Then, the next components to be tested are those that call the previously tested ones. This approach is followed repeatedly until all components are included in the testing.

6.4 Overall System Testing

The primary objective of overall system testing is to ensure the system does what the customer (MPC) requested or meet the system objectives. System testing is actually a series of being carried out to fully exercise parallel in the system. It must be combined with other system elements such as hardware and database. This testing is used to ensure that all the components or modules of the system are functioning properly.

6.5 Acceptance Testing

The final stage in system testing is acceptance testing. The acceptance testing commences when the system is ready to be used. The system will test by target user. For PSMS, the targeted users are MPC members. Users involved in this stage is to make sure the system meets their understanding of the requirements, which may be different from the developer. Finally, the users can be assured that the system has fulfilled all the requirements specification at the early stage of the system development.

6.6 Test Case Report

To fulfill the software development cycle, the system was tested by MPC members. There are two users involve in this acceptance testing. They feel satisfied with the system and they also give some commands and feedback to this system (for the commands, please refer to Appendix). The test case report (by Mr. Kamaruzaman Kadir, Manager of Paralympiad Malaysia & Event, MPC) was shown as below:

No	Test Condition	Expected Result / Objective	Pass/Fail	Remarks
1	Interface – Main Page	User interface	Pass	Pictures to be improve
2	Interface – Other pages	User interface	Pass	–
3	Main Page	List Down all the Paralympic event.	Pass	–
4	Access the Issues and Risks Module.	The Issue List page is displayed. A list of all issue is displayed.	Pass	–
5	User clicks on the menu button.	The links of the Issue List page is displayed. The button is highlighted.	Pass	–
6	User clicks on the link.	The Issue List page is displayed.	Pass	–
7	Administrator Login	Protect the database	Pass	–
8	View Data in List (Issue List Page)	Display a list of data in table form with selected information.	Pass	–

No	Test Condition	Expected Result / Objective	Pass/Fail	Remarks
9	User clicks on the "New issue" link (located at the top right of the page)	The Issue Form is displayed.	Pass	–
10	User creates a new issue. User enters the following valid data and clicks "Add"	Error message is displayed when user key in the invalid data. Data will be inserted into database.	Pass	–
11	User clicks on an issue link (at the Issue List page) to view a project.	The Issue Form is displayed with the detail information.	Pass	–
12	User clicks on "Update" (located at the Menu Bar).	The new data will be inserted into database.	Pass	–
13	User clicks on "Delete" (located at the Menu Bar).	The Confirm Delete page is displayed.	Pass	–
14	User clicks on "Cancel" in the Confirm Delete page.	Return to the current page.	Pass	–
15	User clicks on "OK" in the Confirm Delete page.	The selected issue is deleted.	Pass	–
16	Display data by type	Display Data according to type chosen by user.	Pass	–

No	Test Condition	Expected Result / Objective	Pass/Fail	Remarks
17	Search Module	Search data and display the searched data.	Pass	–

Table 6.1: Test Case Report

6.7 Chapter Summary

System testing is divided to unit testing, integration testing, overall system testing, and acceptance testing. The acceptance testing was done by MPC and the test case report was included in this chapter. From the test case report, MPC was satisfied with PSAMS.

Chapter 7: System Evaluation

~ **Problems Encountered and Solutions**
~ **System Strengths**
~ **System Limitations**
~ **Future Enhancements**
~ **Chapter Summary**

Chapter 7: System Evaluation

This chapter will discuss the system strengths, limitations, and the future enhancements for the system.

7.1 Problems Encountered and Solutions

Because of the time constraint, a number of problems were encountered throughout the development of this system. Encountering with these problems has been proven to be a valuable learning experience.

7.1.1 Difficulties In Determining The Scope Of The System

It is impossible to build a full-scale complete system within the short time frame. Thus, not all fields in Paralympic sport are put into this system., only the critical functions were added into the system.

7.1.2 Problems In Choosing Tools And Language

There are quite a number of scripting languages. All the scripting language and tools allows the user to achieve the same end-result-that dynamic web application. Thus, it is difficult to determine the most appropriate language and tools for the development of PSMS. To gain more information of web-based and determine the most appropriate approach to use, in depth studies and research on the web based programming language was carried out in the earlier stage of the development. These activities include Internet surfing, reading topic related magazine and reference books and studying the existing system. Besides, discussions with group members and course mates engaging in similar project were conducted to collect their opinions and ideas.

7.1.3 Lack Of Knowledge In The Languages And Tools

As there is no prior knowledge in programming in a web-based environment, a lot of studies need to be done. Due to the time constraint, learning and developing process was

done in parallel. New programming languages like VBScript and JavaScript need to be learnt within a short time span. During the development of the system, a lot of time spent in looking for solutions to solve the problems that were occurred during the time. When faced problem during coding stage, the problems were tried to be solved through the Internet surfing by downloading tutorial notes and finding solution in forums such as newsgroup.

7.1.4 Designing an Attractive Web Page

It is difficult to design an attractive web page for all kind of users. To make the web page more attractive, PSMS system has add in some animation file and colorful graphics.

7.2 System Strengths

There are several advantages of this system as listed below:

7.2.1 User Friendliness & Easy to Use

The system interface design is attractive, user friendly and easily understood by any users. It tells the users how to work with this system. Users have the controls of the system function flow by just click on the button. It incorporates a standard homepage with a consistent environment. This system is also very easy to use. The commands and the layouts are simple, logical, tidy and well organized. Therefore, it is easy to learn up, use and understandable.

7.2.2 Password Protected Administrator Site

This super administrator and assistant administrator section is a password-protected site. Only the authorized administrators are allows adding, updating and deleting records in data store. This also prevent unauthorized users change the records in data store.

7.2.3 System Transparency

System transparency refers to the condition where the users do not need to know where the database resides, how is the system structure, its database management system and anything related to the system built. Users are just required to know how to communicate with the user interface.

7.2.4 Analyzing Report Generating

PSMS will generate analyzing reports for users reference. The generated reports are displayed in bar chart and table. The generated reports are:

- ✓ Medals table for every game
- ✓ Volunteer analyzing report
- ✓ Participated countries analyzing report

7.2.5 Validation for Data Input

Data input of administrator is validated and verified to prevent errors caused by the invalid input. If there is an input failure, an error message is prompted to inform the user about the error.

7.3 System Limitations

However, there are limitations in this system that are not resolved yet.

7.3.1 Limited in System Modules/Functionality

This system provides only a few functions or modules to user. It is not yet a complete Paralympic Sport management system that handles all fields in sport management. This system only provides the critical modules to management the Paralympic sport event organized by MPC.

7.3.2 Web Browser Limitations

These web pages are developed using Microsoft Internet Explorer 5.0. It is not fully tested in all web browser such as Netscape Navigator. Thus, it may not display correctly by using other web browser except Microsoft Internet Explorer 5.0.

7.3.3 Not Fully Integrated with POSC (online system)

As mention earlier, this project will be integrated with another two system, PAMS and POSC. However, the integration between PSMS and POSC is not fully integrated. The PSMS web page only provides the link to POSC and no exchange data processes are involved.

7.3.4 Limited Categories of Users

This PSMS system only will be used as intranet system in MPC. Thus, other people cannot access the system without connection to MPC intranet system.

7.4 Future Enhancements

The system should be maintained throughout the lifetime of the system because the user requirements might vary from times to times. Enhancement in the future will extend the usability of this system. Moreover, the system limitations should be improved to enhance functionality.

Here are some suggestions and possible future enhancements:

7.4.1 Provide a Print Out Function

It is recommended that a print out function to be added so that the record can be printed out. This function also needed to print out the forms when manual system is needed.

7.4.2 Enhance User Interface

User interface should enhance from time to time. Multimedia elements such as animated graphics and Flash movies should be added to increase its attractiveness, impressive and interactive.

7.4.3 More Functionality Added

PSMS may add in other module to enhance the performance of the system. The modules or functionality that may added in are:

- ✓ Promotion & Marketing
- ✓ Opening & Closing Ceremony
- ✓ Security & Traffic
- ✓ Invitation & Protocol

7.4.4 Voice System

Some of the users for PSMS may be the disable group, it is recommended to add in a voice system so that this system can be used for more users in MPC.

7.4.5 Integration with POSC

For future enhancement, integration with POSC is needed to retrieve volunteer data from POSC. In POSC, public can register as volunteer, after finalist the volunteers, it will be added to PSMS. If PSMS and POSC are integrated, it is easier for administrator to get data from POSC.

7.5 Chapter Summary

This chapter discusses the problems faced during system development, system strengths, limitations, and the future enhancements for the system. Because of the time constrains, many problems need to be solved and the system also contains some limitation. To enhance this system, some of the function may add in. For example, print out function, voice system, and integration with POSC.

Chapter 8: Conclusion

Chapter 8: Conclusion

8.1 Conclusion

Paralympic Sport Management System (PSMS) is a system required by Malaysian Paralympic Council (MPC) to automate the current manual system. PSMS is a management information system that helps MPC in organizes a Paralympic sport. It provides a database system that able to reduce the inconveniences in current paper-based system. PSMS contains some useful modules in organize a game, e.g. volunteer and staff management, equipment and result management, schedule and venue arrangement, creating committee structure. Only administrator or assistant administrators are allowed to change these data after login their username and password. PSMS will be integrated with another two system to provide a collaborative system named as Paralympic Information and Management System (PIMS). These two systems are Paralympic One-Stop Center (POSC), which is an Internet system and Paralympic Athletes Management System (PAMS), which is an Intranet system as well. POSC provides an on-line registration for volunteers and athletes and will display the information about MPC and Paralympic sport information. While the PAMS is a management information system for athlete management.

This project is very important and beneficial. In the process of developing the system, a lot of useful knowledge and valuable experience were gained. These include knowledge in Internet technologies, and concepts in coding, programming in HTML, ASP, and others are valuable experiences. Besides, experience in graphic editing using Adobe an SWiSH 2.0 also provides me a great chance to learn these tools. Finally, there are many individual skills can learn from this project. Mainly it is the presentation skill and communication skills with people for asking opinions, advices, guidance and help. Besides, this project has given me a profound impact in management. All the problems faced and experience gained during the system development would be useful in my future career since era is now moving towards Internet technology that requires decent technical and practical knowledge in development of web application. In conclusion, involving in this PSMS development is a valuable experience for me.

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